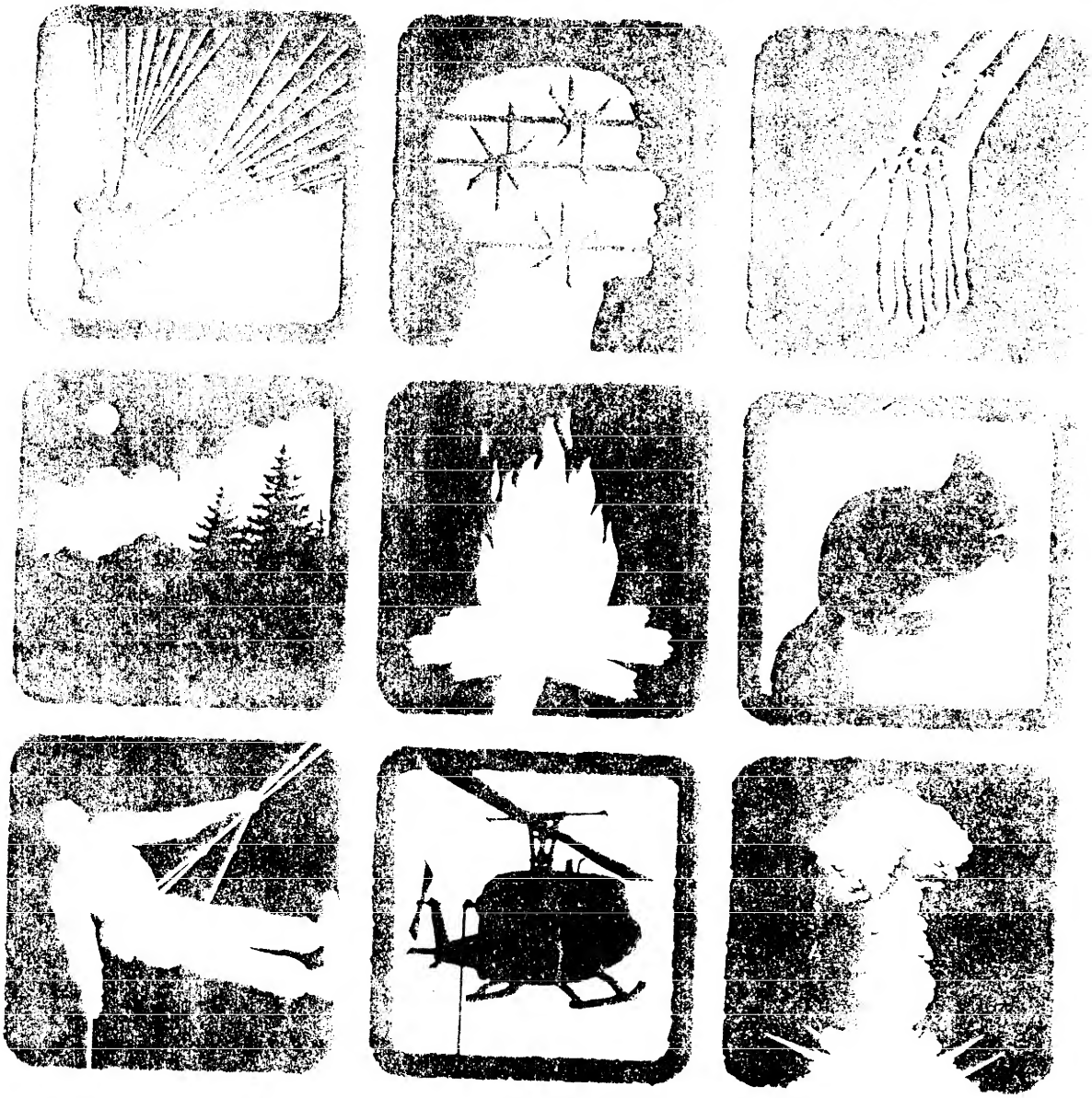
AF REGULATION 64-4
VOLUME 1

Search and Rescue

SURVIVAL TRAINING



SURVIVE • RETURN • HONOR

15 JULY 1985

DEPARTMENT OF THE AIR FORCE

DEPARTMENT OF THE AIR FORCE
Headquarters US Air Force
Washington DC 20330-5000

AF REGULATION 64-4
VOLUME I
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Search and Rescue

SURVIVAL TRAINING

This regulation describes the various environmental conditions affecting human survival, and describes individual activities necessary to enable that survival. This regulation is for instructor and student use in formal and USAF survival and survival continuation training. This regulation also applies to US Air Force Reserve and Air National Guard units and members. Sources used to compile this regulation are listed in the bibliography, attachment 1.

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Part One

THE ELEMENTS OF SURVIVING

Chapter 1

MISSION

1-1. Introduction. An ejection sequence, a bailout, or crash landing ends one mission for the crew but starts another—to successfully return from a survival situation. Are they prepared? Can they handle the new mission, not knowing what it entails? Unfortunately, many aircrew members are not fully aware of their new mission or are not fully prepared to carry it out. All instructors teaching aircrew survival must prepare the aircrew member to face and successfully complete this new mission. (Figure 1-1 shows situations a member might encounter.)

1-2. Aircrew Mission. The moment an aircrew member leaves the aircraft and encounters a survival situation, the assigned mission is to: "return to friendly control without giving aid or comfort to the enemy, to return early and in good physical and mental condition."

a. On first impressions, "friendly control" seems to relate to a combat situation. Even in peacetime, however, the environment may be quite hostile. Imagine parachuting into the arctic when it's minus 40°F. Would an aircrew member consider this "friendly?" No. If the aircraft is forced to crash-land in the desert where temperatures may soar above 120°F, would this be agreeable? Hardly. The possibilities for encountering hostile conditions affecting human survival are endless. Crewmembers who egress an aircraft may confront situations difficult to endure.

b. The second segment of the mission, "without giving aid or comfort to the enemy," is directly related to a combat environment. This part of the mission may be most effectively fulfilled by following the moral guide—the Code of Conduct. Remember, however, that the Code of Conduct is useful to a survivor at all times and in all situations. Moral obligations apply to the peacetime situation as well as to the wartime situation.

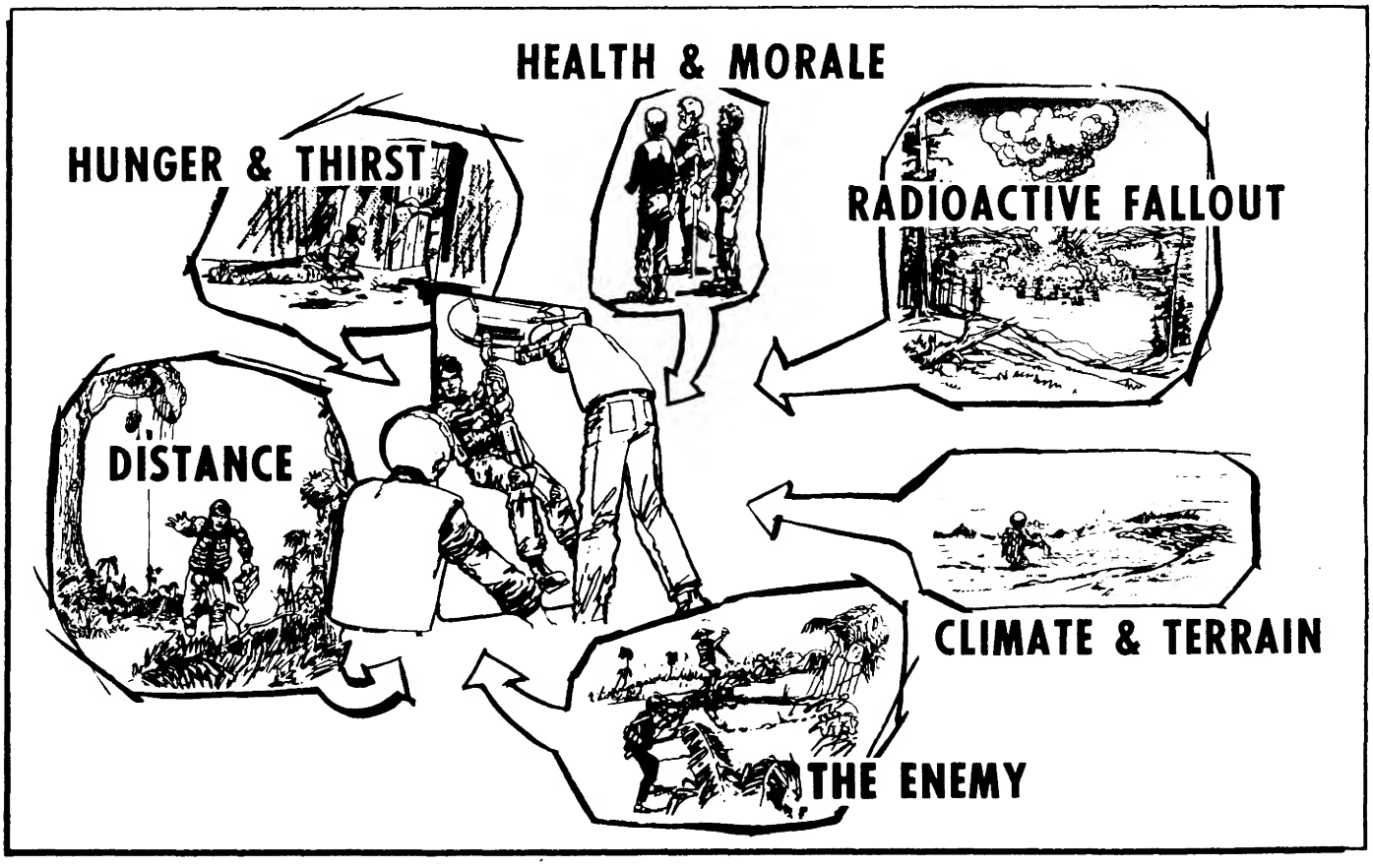


Figure 1-1. Elements of Surviving.

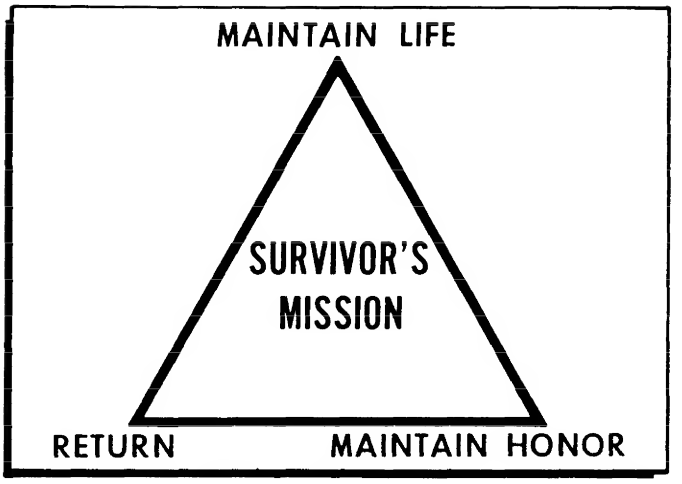


Figure 1-2. Survival Triangle.

c. The final phase of the mission is "to return early and in good physical and mental condition." A key factor in successful completion of this part of the mission may be the *will to survive.* This will is present, in varying degrees, in all human beings. Although successful survival is based on many factors, those who maintain this important attribute will increase their chance of success.

1-3. Goals. Categorizing this mission into organizational components, the three goals or duties of a survivor are to maintain life, maintain honor, and return. Survival training instructors and formal survival training courses provide training in the skills, knowledge, and attitudes necessary for an aircrew member to successfully perform the fundamental survival duties shown in figure 1-2.

1-4. Survival. Surviving is extremely stressful and difficult. The survivor may be constantly faced with hazardous and difficult situations. The stresses, hardships, and hazards (typical of a survival episode) are caused by the cumulative effects of existing conditions. (See chapter 2 pertaining to conditions affecting survival.) Maintaining life and honor and returning, regardless of the conditions, may make surviving difficult or unpleasant. The survivor's mission forms the basis for identifying and organizing the major needs of a survivor. (See survivor's needs in chapter 3.)

1-5. Decisions. The decisions survivors make and the actions taken in order to survive determine their prognosis for surviving.

1-6. Elements. The three primary elements of the survivor's mission are: the conditions affecting survival, the survivor's needs, and the means for surviving.

Chapter 2

CONDITIONS AFFECTING SURVIVAL

2-1. Introduction. Five basic conditions affect every survival situation (figure 2-1). These conditions may vary in importance or degree of influence from one situation to another and from individual to individual. At the onset, these conditions can be considered to be neutral—being neither for nor against the survivor, and should be looked upon as neither an advantage nor a disadvantage. The aircrew member may succumb to their effects—or use them to best advantage. These conditions exist in each survival episode, and they will have great bearing on the survivor's every need, decision, and action.

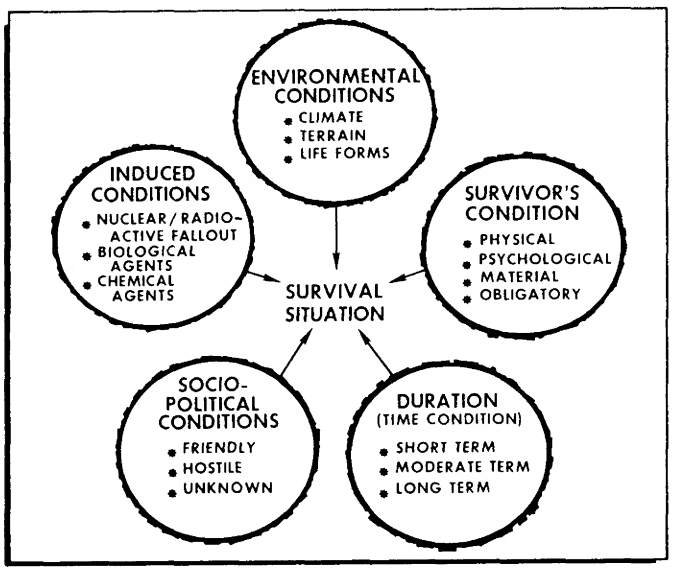


Figure 2-1. Five Basic Conditions.

2-2. Environmental Conditions. Climate, terrain, and life forms are the basic components of all environments. These components can present special problems for the survivor. Each component can be used to the survivor's advantage. Knowledge of these conditions may very well contribute to the success of the survival mission.

a. Climate. Temperature, moisture, and wind are the basic climatic elements. Extreme cold or hot temperatures, complicated by moisture (rain, humidity, dew, snow, etc.) or lack of moisture, and the possibility of wind, may have a life threatening impact on the survivor's needs, decisions, and actions. The primary concern, resulting from the effects of climate, is the need for personal protection. Climatic conditions also have a significant impact on other aspects of survival (for example, the availability of water and food, the need and ability to travel, recovery capabilities, physical and psychological problems, etc.) (figure 2-2).

b. Terrain. Mountains, prairies, hills, and lowlands, are only a few examples of the infinite variety of land forms which describe "terrain." Each of the land forms have a different effect on a survivor's needs, decisions, and actions. A survivor may find a combination of several terrain forms in a given situation. The existing terrain will affect the survivor's needs and activities in such areas as travel, recovery, sustenance, and, to a lesser extent, personal protection. Depending on its form, terrain may afford security and concealment for an evader; cause travel to be easy or difficult; provide protection from cold, heat, moisture, wind, or nuclear, biological, chemical (NBC) conditions; or make surviving a *seemingly* impossible task (figure 2-3).

c. Life Forms. For survival and survival training purposes, there are two basic life forms—plant life and animal life (other than human). NOTE: The special relationship and effects of people on the survival episode are covered separately. Geographic areas are often identified in terms of the abundance of life (or lack thereof). For example, the barren arctic or desert, primary (or secondary) forests, the tropical rain forest, the polar ice cap, etc., all produce images regarding the quantities of life forms. These examples can have special meaning not only in terms of the hazards or needs they create, but also in how a survivor can use available life forms (figure 2-4).

(1) Plant Life. There are hundreds of thousands of different types and species of plant life. In some instances, geographic areas are identified by the dominant types of plant life within that area. Examples of this are savannas, tundra, deciduous forests, etc. Some species of plant life can be used advantageously by a survivor—if not for the food or the water, then for improvising camouflage, shelter, or providing for other needs.

(2) Animal Life. Reptiles, amphibians, birds, fish, insects, and mammals are life forms which directly affect a survivor. These creatures affect the survivor by posing hazards (which must be taken into consideration), or by satisfying needs.

2-3. The Survivor's Condition. The survivor's condition and the influence it has in each survival episode is often overlooked. The primary factors which constitute the survivor's condition can best be described by the four categories shown in figure 2-5. Aircrew members must prepare themselves in each of these areas before each mission, and be in a state of "constant readiness" for the possibility of a "survival mission." Crewmembers must be aware of the role a survivor's condition plays both before and during the survival episode.

a. Physical. The physical condition and the fitness level of the survivor are major factors affecting

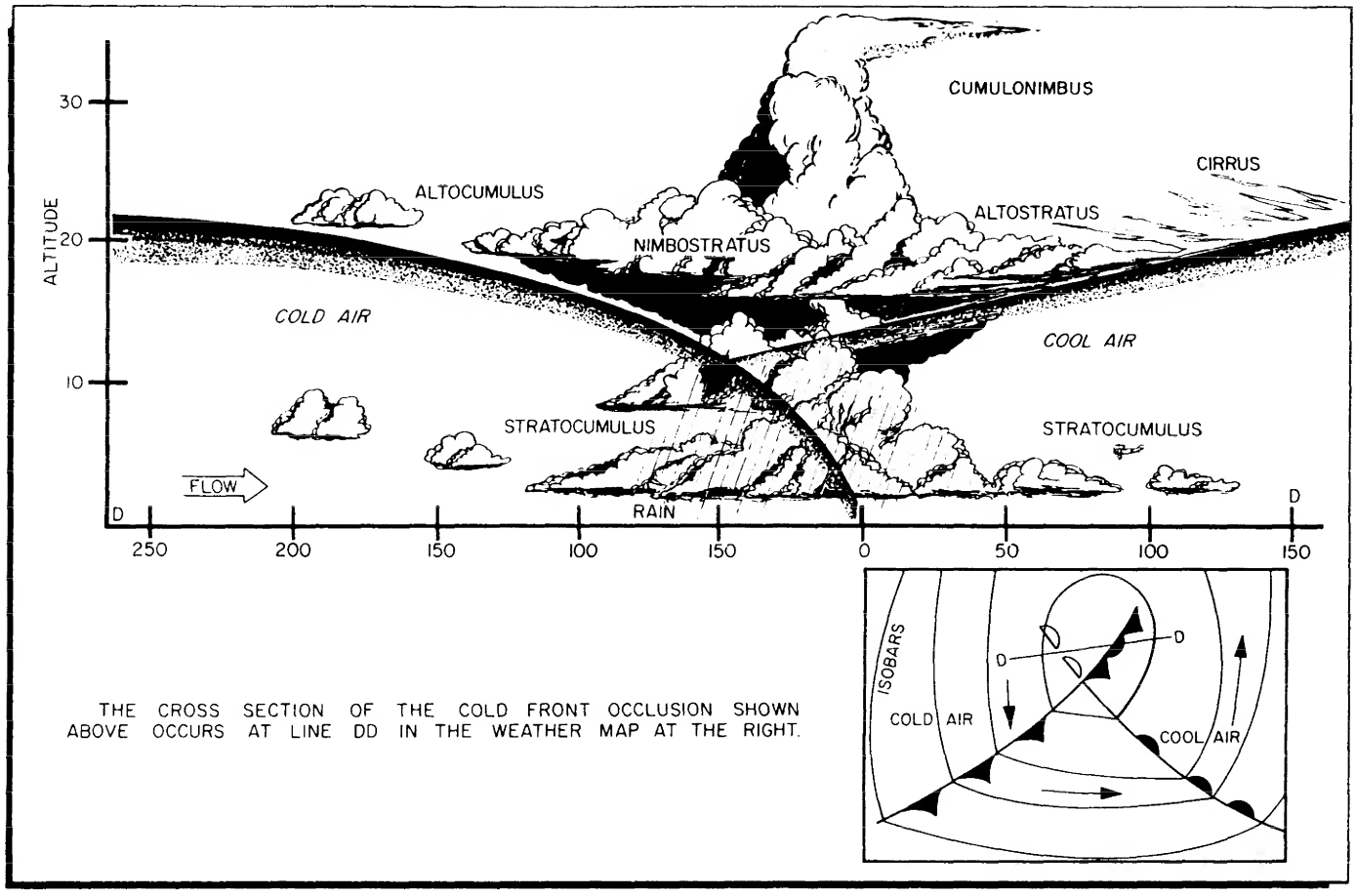


Figure 2-2. Cold Front Occlusion.

survivability. Aircrew members who are physically fit will be better prepared to face survival episodes than those who are not. Further, a survivor's physical condition (injured or uninjured) during the initial phase of a survival episode will be a direct result of circumstances surrounding the ejection, bailout, parachute landing, or crash landing. In short, high levels of physical fitness and good post-egress physical condition will enhance a survivor's ability to cope with such diverse variables as: (1) temperature extremes, (2) rest or lack of it, (3) water availability, (4) food availability, and (5) extended survival episodes. In the last instance, physical weakness may increase as a result of nutritional deficiencies, disease, etc.

b. Psychological. Survivors' psychological state greatly influences their ability to successfully return from a survival situation.

(1) Psychological effectiveness in a survival episode (including captivity) results from effectively coping with the following factors:

(a) Initial shock - Finding oneself in a survival situation following the stress of ejection, bailout, or crash landing.

(b) Pain - Naturally occurring or induced by coercive manipulation.

(c) Hunger - Naturally occurring or induced by coercive manipulation.

(d) Thirst - Naturally occurring or induced by coercive manipulation.

(e) Cold or Heat - Naturally occurring or induced by coercive manipulation.

(f) Frustration - Naturally occurring or induced by coercive manipulation.

(g) Fatigue (including Sleep Deprivation). - Naturally occurring or induced by coercive manipulation.

(h) Isolation - Includes forced (captivity) and the extended duration of any episode.

(i) Insecurity - Induced by anxiety and self-doubts.

(j) Loss of self-esteem - Most often induced by coercive manipulation.

(k) Loss of self-determination - Most often induced by coercive manipulation.

(l) Depression - Mental "lows."

(2) A survivor may experience emotional reactions during a survival episode due to the previously stated

Figure 2-3. Terrain.

factors, previous (life) experiences (including training) and the survivor's psychological tendencies. Emotional reactions commonly occurring in survival (including captivity) situations are:

(a) Boredom - sometimes combined with loneliness.

(b) Loneliness.

(c) Impatience.

(d) Dependency.

(e) Humiliation.

(f) Resentment.

(g) Anger - sometimes included as a subelement of hate.

(h) Hate.

(i) Anxiety.

(j) Fear - often included as a part of panic or anxiety.

(k) Panic.

Figure 2-4. Life Forms.

(3) Psychologically survival episodes may be divided into "crisis" phases and "coping" phases. The initial crisis period will occur at the onset of the survival situation. During this initial period, "thinking" as well as "emotional control" may be disorganized. Judgment is impaired, and behavior may be irrational (possibly to the point of panic). Once the initial crisis is under control, the coping phase begins and the survivor is able to respond positively to the situation. Crisis periods may well recur, especially during extended situations (captivity). A survivor must strive to control if avoidance is impossible.

(4) The most important psychological tool that will affect the outcome of a survival situation is the *will to survive.* Without it, the survivor is surely doomed to failure—a strong will is the best assurance of survival.

c. Material. At the beginning of a survival episode, the clothing and equipment in the aircrew member's possession, the contents of available survival kits, and salvageable resources from the parachute or aircraft are the sum total of the survivor's material assets. Adequate premission preparations are required (must be stressed during training). Once the survival episode has started, special attention must be given to the care, use, and storage of all materials to ensure they continue to be

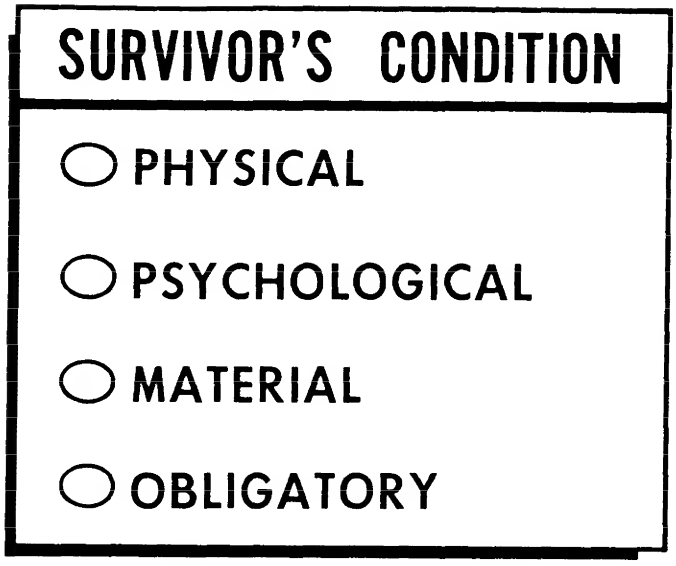


Figure 2-5. Survivor's Condition.

serviceable and available. Items of clothing and equipment should be selectively augmented with improvised items.

(1) Clothing appropriate to anticipated environmental conditions (on the ground) should be worn or carried as aircraft space and mission permit.

(2) The equipment available to a survivor affects all decisions, needs, and actions. The survivor's ability to improvise may provide ways to meet some needs.

d. Legal and Moral Obligations. A survivor has both legal and moral obligations or responsibilities. Whether in peacetime or combat, the survivor's responsibilities as a member of the military service continues. Legal obligations are expressly identified in the Geneva Conventions, Uniform Code of Military Justice (UCMJ), and Air Force directives and policies. Moral obligations are expressed in the Code of Conduct. (See figure 2-6.)

(1) Other responsibilities influence behavior during survival episodes and influence the *will to survive.* Examples include feelings of obligation or responsibilities to family, self, and(or) spiritual beliefs.

(2) A survivor's individual perception of responsibilities influence survival needs, and affect the psychological state of the individual both during and after the survival episode. These perceptions will be reconciled either consciously through rational thought or subconsciously through attitude changes. Training specifically structured to foster and maintain positive attitudes provides a key asset to survival.

2-4. Duration—The Time Condition. The duration of the survival episode has a major effect upon the aircrew member's needs. Every decision and action will be driven in part by an assessment of when recovery or return is probable. Air superiority, rescue capabilities, the distances involved, climatic conditions, the ability to locate the survivor, or captivity are major factors which directly influence the duration (time condition) of the survival episode. A survivor can never be certain that rescue is imminent.

2-5. Sociopolitical Condition. The people a survivor contacts, their social customs, cultural heritage, and political attitudes will affect the survivor's status. Warfare is one type of sociopolitical condition, and people of different cultures are another. Due to these sociopolitical differences, the interpersonal relationship between the survivor and any people with whom contact is established is crucial to surviving. To a survivor, the attitude of the people contacted will be friendly, hostile, or unknown.

a. Friendly People. The survivor who comes into contact with friendly people, or at least those willing (to some degree) to provide aid, is indeed fortunate. Immediate return to home, family, or home station, however, may be delayed. When in direct association with even the friendliest of people, it is essential to maintain their friendship. These people may be of a completely different culture in which a commonplace American habit may be a gross and serious insult. In other instances, the friendly people may be active insurgents in their country and constantly in fear of discovery. Every survivor action, in these instances, must be appropriate and acceptable to ensure continued assistance.

b. Hostile People. A state of war need not exist for a survivor to encounter hostility in people. With few exceptions, any contact with hostile people must be avoided. If captured, regardless of the political or social reasons, the survivor must make all efforts to adhere to the Code of Conduct and the legal obligations of the UCMJ, the Geneva Conventions, and USAF policy.

c. Unknown People. The survivor should consider all factors before contacting unknown people. Some primitive cultures and closed societies still exist in which outsiders are considered a threat. In other areas of the world, differing political and social attitudes can place a survivor "at risk" in contacting unknown people.

2-6. Induced Conditions. Any form of warlike activity results in "induced conditions." Three comparatively new induced conditions may occur during combat operations. Nuclear warfare and the resultant residual radiation, biological warfare, and chemical warfare (NBC) create life-threatening conditions from which a survivor needs immediate protection. The longevity of NBC conditions further complicates a survivor's other needs, decisions, and actions (figure 2-7).

U.S. FIGHTING MAN'S

CODE OF CONDUCT

I

I am an American fighting man. I serve in the forces which guard my country and our way of life. I am prepared to give my life in their defense.

II

I will never surrender of my own free will. If in command, I will never surrender my men while they still have the means to resist.

III

If I am captured, I will continue to resist by all means available. I will make every effort to escape and aid others to escape. I will accept neither parole nor special favors from the enemy.

IV

If I become a prisoner of war, I will keep faith with my fellow prisoners. I will give no information or take part in any action which might be harmful to my comrades. If I am senior, I will take command. If not, I will obey the lawful orders of those appointed over me and will back them up in every way.

V

When questioned, should I become a prisoner of war, I am required to give name, rank, service number, and date of birth. I will evade answering further questions to the utmost of my ability. I will make no oral or written statements disloyal to my country and its allies or harmful to their cause.

VI

I will never forget that I am an American fighting man, responsible for my actions, and dedicated to the principles which made my country free. I will trust in my God and in the United States of America.

Figure 2-6. Code of Conduct.

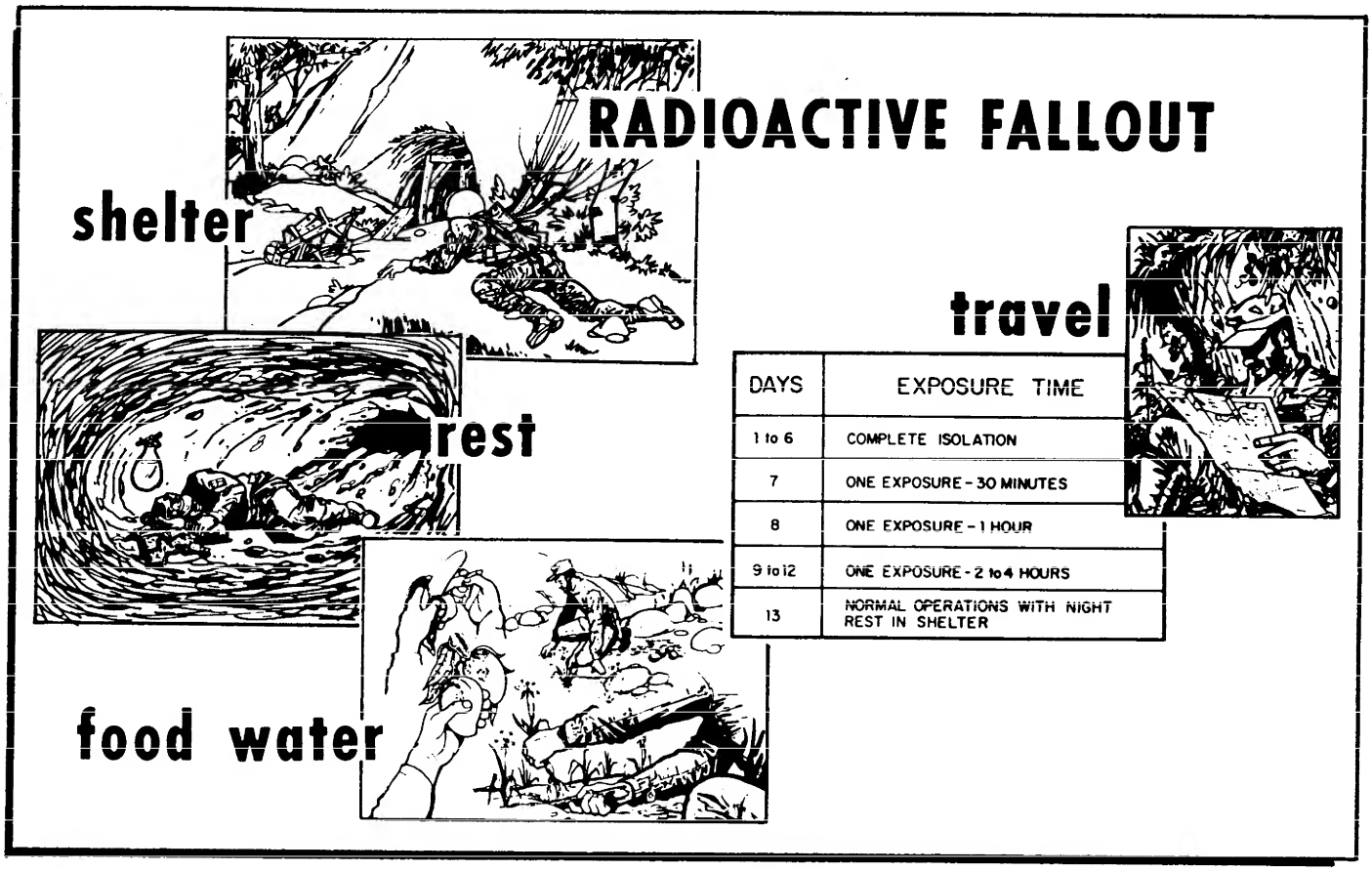


Figure 2-7. Induced Conditions.

Chapter 3

THE SURVIVOR'S NEEDS

3-1. Introduction. The three fundamental goals of a survivor—to maintain life, maintain honor, and return—may be further divided into eight basic needs. In a noncombatant situation, these needs include: personal protection, sustenance, health, travel, and communications (signaling for recovery). During combat, additional needs must be fulfilled. They are: evasion, resistance if captured, and escape if captured. Meeting the individual's needs during the survival episode is essential to achieving the survivor's fundamental goals (figure 3-1).

Figure 3-1. Survivor's Needs.

3-2. Maintaining Life. Three elementary needs of a survivor in any situation which are categorized as the integral components of maintaining life are: personal protection, sustenance, and health.

a. Personal Protection. The human body is comparatively fragile. Without protection, the effects of environmental conditions (climate, terrain, and life forms) and of induced conditions (radiological, biological agents, and chemical agents) may be fatal. The survivor's primary defenses against the effects of the environment are clothing, equipment, shelter, and fire. Additionally, clothing, equipment, and shelter are the primary defenses against some of the effects of induced conditions (figure 3-2).

(1) The need for adequate clothing and its proper care and use cannot be overemphasized. The human body's tolerance for temperature extremes is very limited. However, its ability to regulate heating and cooling is extraordinary. The availability of clothing and its proper use is extremely important to a survivor in using these abilities of the body. Clothing also provides excellent protection against the external effects of alpha and beta radiation, and may serve as a shield against the external effects of some chemical or biological agents.

(2) Survival equipment is designed to aid survivors throughout their episode. It must be cared for to maintain its effectiveness. Items found in a survival kit or aircraft can be used to help satisfy the eight basic needs. Quite often, however, a survivor must improvise to overcome an equipment shortage or deficiency.

(3) The survivor's need for shelter is twofold—as a place to rest and for protection from the effects of the environmental and(or) induced conditions (NBC). The duration of the survival episode will have some effect on shelter choice. In areas that are warm and dry, the survivor's need is easily satisfied using natural resting places. In cold climates, the criticality of shelter can be measured in minutes, and rest is of little immediate concern. Similarly, in areas of residual radiation, the criticality of shelter may also be measured in minutes (figure 3-3).

(4) Fire serves many survivor needs: purifying water, cooking and preserving food, signaling, and providing a source of heat to warm the body and dry clothing (figure 3-4).

b. Sustenance. Survivors need food and water to maintain normal body functions and to provide strength, energy, and endurance to overcome the physical stresses of survival.

(1) Water. The survivor must be constantly aware of the body's continuing need for water (figure 3-5).

(2) Food. During the first hours of a survival situation, the need for food receives little attention. During the first 2 or 3 days, hunger becomes a nagging aggravation which a survivor can overcome. The first major food crisis occurs when the loss of energy, stamina, and strength begin to affect the survivor's physical capabilities. The second major food crisis is more insidious. A marked increase in irritability and other attitudes may occur as the starvation process continues. Early and continuous attention must be given to obtaining and using any and all available food. Most people have food preferences. The natural tendency to avoid certain types of food is a major problem which must be overcome early in the survival situation. The starvation process ultimately overcomes all food aversions. The successful survivor overcomes these aversions before physical or psychological deterioration sets in (figure 3-6).

c. Health (Physical and Psychological). The survivor must be the doctor, nurse, corpsman, psychologist, and cheerleader. Self-aid is the survivor's sole recourse.

(1) Prevention. The need for preventive medicine and safety cannot be overemphasized. Attention to sani-

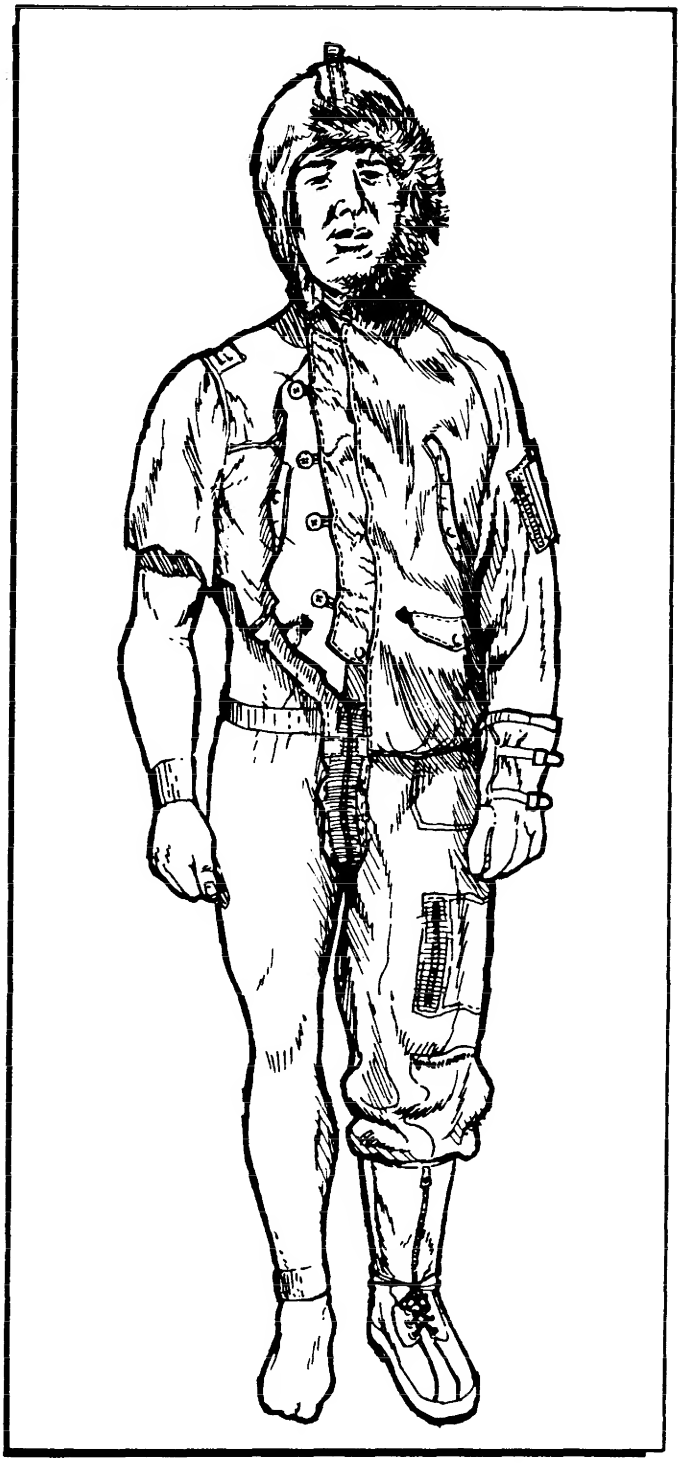


Figure 3-2. Personal Protection.

tation and personal hygiene is a major factor in preventing physical, morale, and attitudinal problems.

(a) The need for cleanliness in the treatment of injuries and illness is self-evident. The prisoner of war (PW) who used maggots to eat away rotting flesh caused by infection is a dramatic example. Prevention is much more preferred than such drastic procedures.

(b) Safety must be foremost in the mind of the survivor; carelessness is caused by ignorance and(or) poor judgment or bad luck. One miscalculation with a knife or ax can result in self-inflicted injury or death.

(2) Self-Aid:

(a) Injuries frequently occur during ejection, bailout, parachute landing, or ditching. Other post-egress factors may also cause injury. In the event of injury, the survivor's existence may depend on the ability to perform self-aid. In many instances, common first aid procedures will suffice; in others, more primitive techniques will be required (figure 3-7).

(b) Illness and the need to treat it is more commonly associated with long-term situations such as an extended evasion episode or captivity. When preventive techniques have failed, the survivor must treat symptoms of disease in the absence of professional medical care.

(3) Psychological Health. Perhaps the survivor's greatest need is the need for emotional stability and a positive, optimistic attitude. An individual's ability to cope with psychological stresses will enhance successful survival. Optimism, determination, dedication, and humor, as well as many other psychological attributes, are all helpful for a survivor to overcome psychological stresses (figure 3-8).

3-3. Maintaining Honor. Three elementary needs which a survivor may experience during combat survival situations are categorized as integral components of maintaining honor. These three elementary needs are: (a) avoiding capture or evading, (b) resisting (if captured), and (c) escaping (if captured).

a. Avoiding Capture. Evasion will be one of the most difficult and hazardous situations a survivor will face. However difficult and hazardous evasion may be, captivity is always worse. During an evasion episode, the survivor has two fundamental tasks. The first is to use concealment techniques. The second is to use evasion movement techniques. The effective use of camouflage is common to both of these activities.

(1) Hiding oneself and all signs of presence are the evader's greatest needs. Experience indicates that the survivor who uses effective concealment techniques has a better chance of evading capture. Capture results most frequently when the evader is moving.

(2) The evader's need to move depends on a variety of needs such as recovery, food, water, better shelter, etc. Evasion movement is more successful when proven techniques are used.

b. Resisting. The PW's need to resist is self-evident. This need is both a moral and a legal obligation. Resistance is much more than refusing to divulge some bit of classified information. Fundamentally, resisting is two distinctly separate behaviors expected of the prisoner:

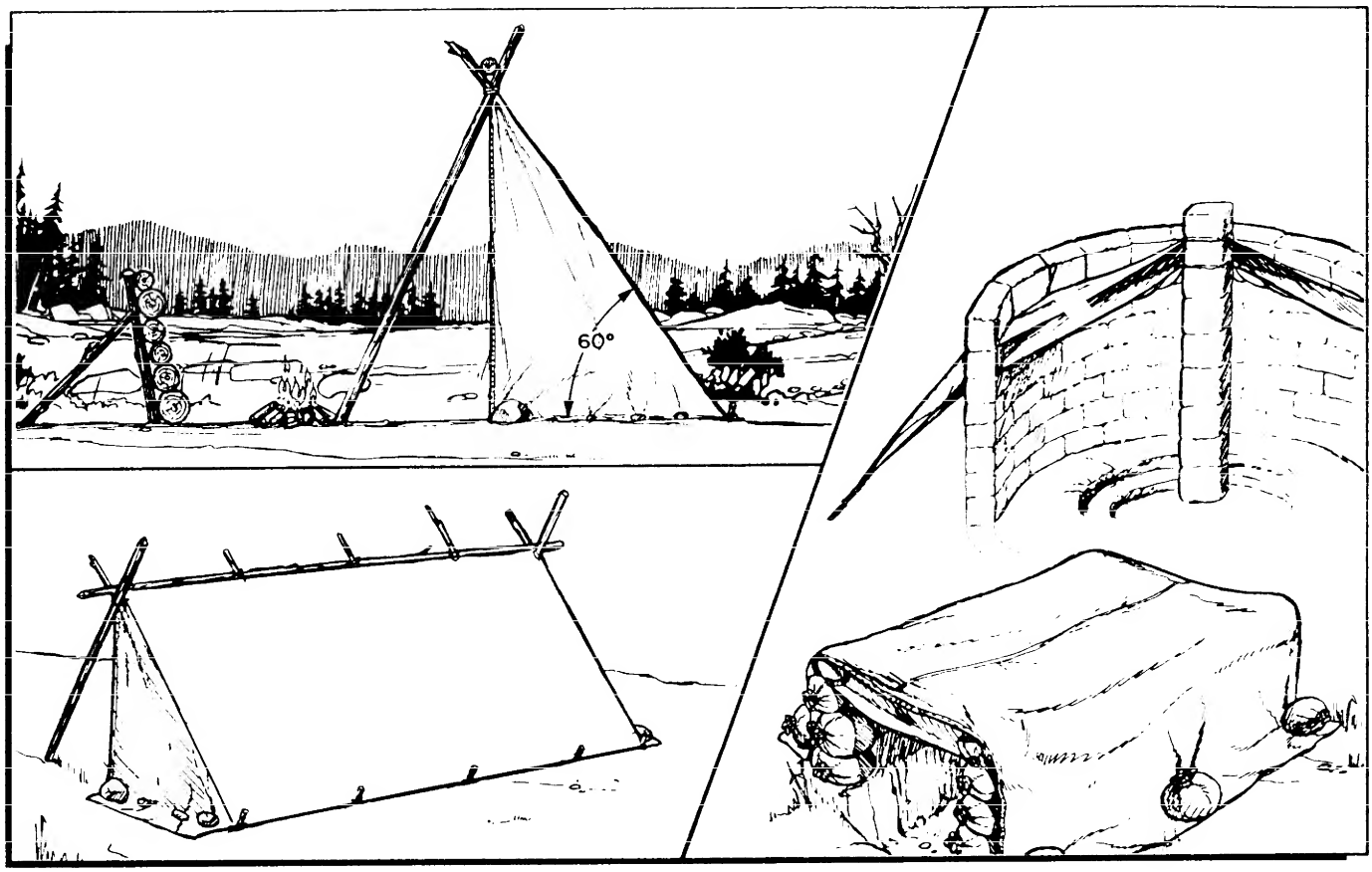


Figure 3-3. Shelters.

(1) Complying with legal and authorized requirements only.

(2) Disrupting enemy activity through resisting, subtle harrassment, and tying up enemy guards who could be used on the front lines.

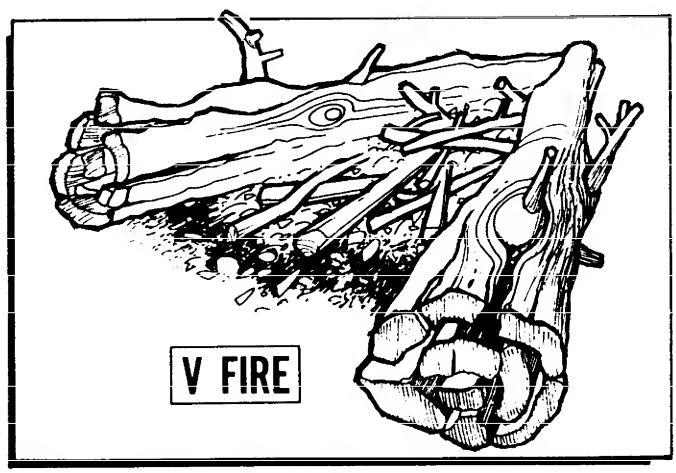


Figure 3-4. Fire.

c. Escaping (When Possible and Authorized). Escape is neither easy nor without danger. The Code of Conduct states a survivor should make every effort to escape and aid others to escape.

3-4. Returning. The need to return is satisfied by successful completion of one or both of the basic tasks confronting the survivor: aiding with recovery and traveling (on land or water).

a. Aiding With Recovery. For survivors or evaders to effectively aid in recovery, they must be able to make their position and the situation on the ground known. This is done either electronically, visually, or both (figure 3-9).

(1) Electronic signaling covers a wide spectrum of techniques. As problems such as security and safety during combat become significant factors, procedures for using electronic signaling to facilitate recovery become increasingly complex.

(2) Visual signaling is primarily the technique for attracting attention and pinpointing an exact location for rescuers. Simple messages or information may also be transmitted with visual signals.

b. Travel On Land. A survivor may need to move on land for a variety of reasons, ranging from going for

Figure 3-5. Water.

water to attempting to walk out of the situation. In any survival episode, the survivor must weigh the need to travel against capabilities and(or) safety (figure 3-10). Factors to consider may include:

Figure 3-6. Food.

(1) The ability to walk or traverse existing terrain. In a nonsurvival situation, a twisted or sprained ankle is an inconvenience accompanied by some temporary pain and restricted activity. A survivor who loses the mobility, due to injury, to obtain food, water, and shelter, can face death. There is a safe and effective way to travel across almost any type of terrain.

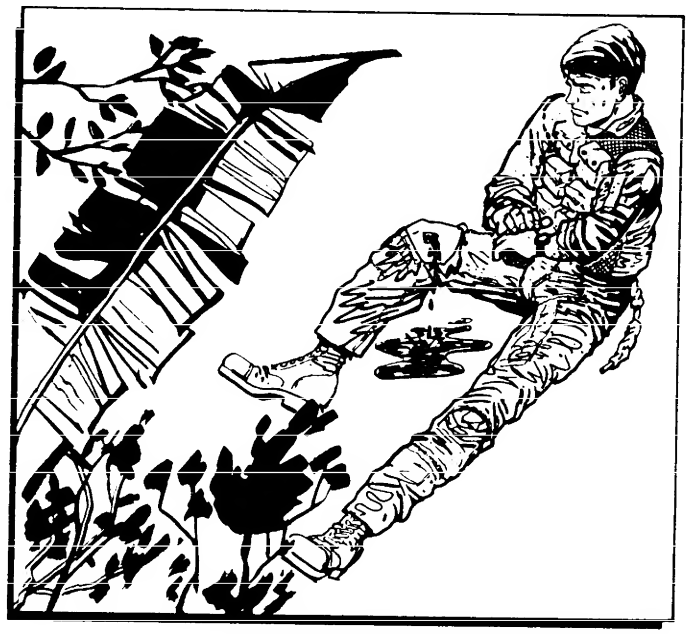


Figure 3-7. Self-Aid.

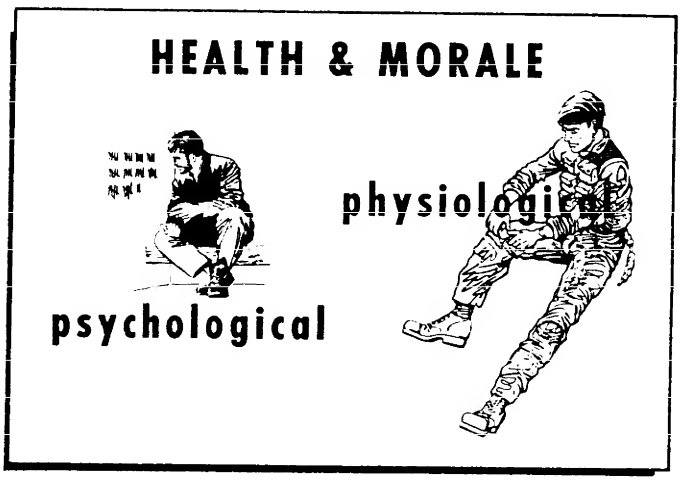


Figure 3-8. Health and Morale.

(2) The need to transport personal possessions (burden carrying). There are numerous documented instances of survivors abandoning equipment and clothing simply because carrying was a bother. Later, the abandoned materials were not available when needed to save life, limb, or aid in rescue. Burden carrying need not be difficult or physically stressful. There are many simple ways for a survivor to carry the necessities of life (figure 3-11).

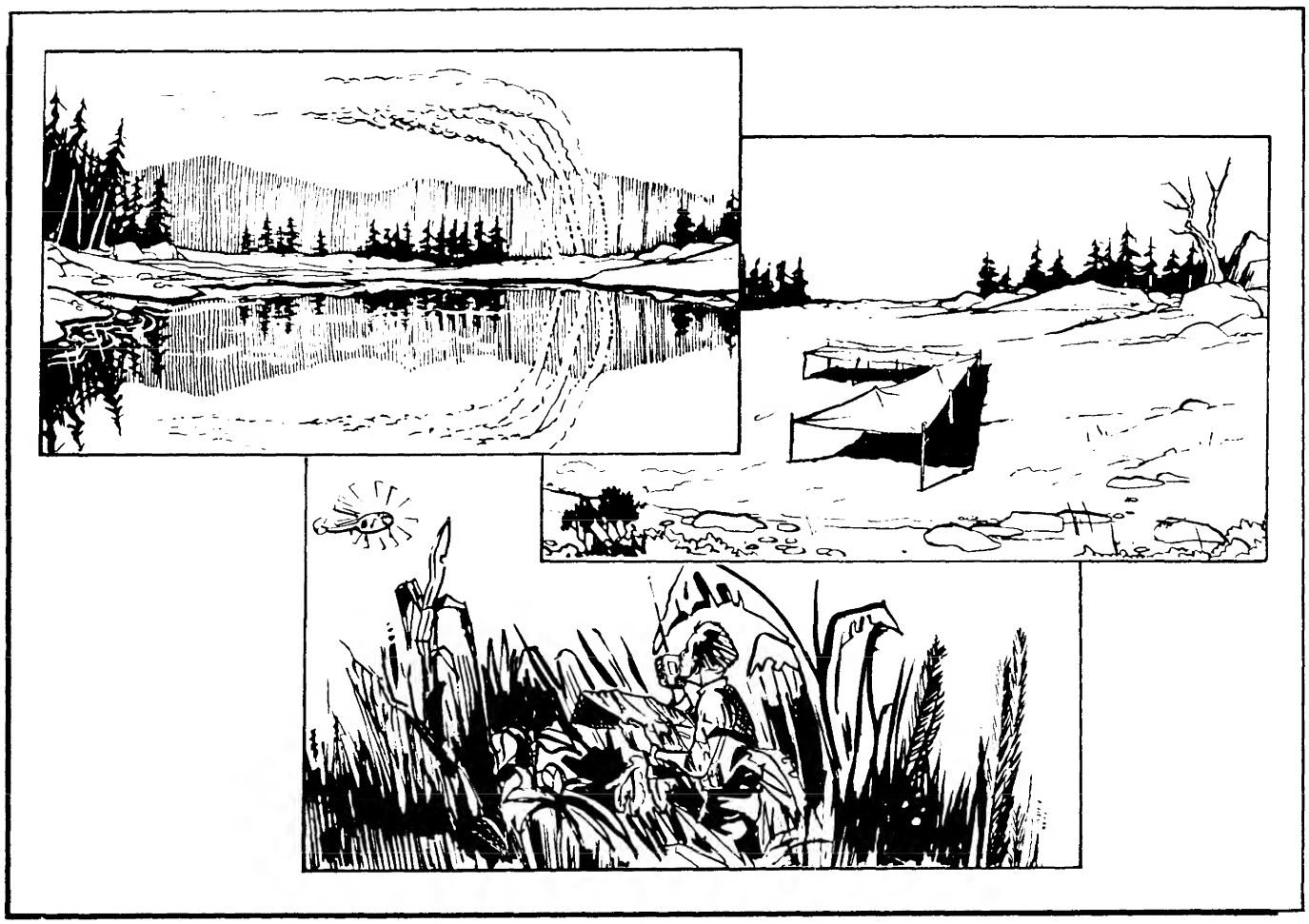


Figure 3-9. Recovery.

(3) The ability to determine present position. Maps, compasses, star charts, Weems plotters, etc., permit accurate determination of position during extended travel. Yet, the knowledgeable, skillful, and alert survivor can do well without a full complement of these aids. Constant awareness, logic, and training in nature's clues to navigation may allow a survivor to determine general location even in the absence of detailed navigation aids.

(4) Restrictions or limitations to select and maintain a course of travel. The tools used in determining position are the tools used to maintain a course of travel. A straight line course to a destination is usually the simplest, but may not always be the best course for travel. Travel courses may need to be varied for diverse reasons, such as to get food or water, to enhance covert travels or to avoid hazardous or impassable obstacles or terrain. Careful planning and route selection before and during travel is essential.

c. Travel On Water. Two differing circumstances may require survivors to travel on water. First, those who crash-land or parachute into the open sea are confronted with one type of situation. Second, survivors who find a river or stream which leads in a desirable direction are faced with a different situation. In each instance, however, a common element is to stay afloat.

(1) The survivor's initial problems on the open sea are often directly related to the winds and size of the waves. Simply getting into a liferaft and staying there are often very difficult tasks. On the open sea, the winds and ocean currents have a significant effect on the direction of travel. As the survivor comes closer to shore, the direction in which the tide is flowing also becomes a factor. There are some techniques a survivor can use to aid with stabilizing the raft, controlling the direction and rate of travel, and increasing safety.

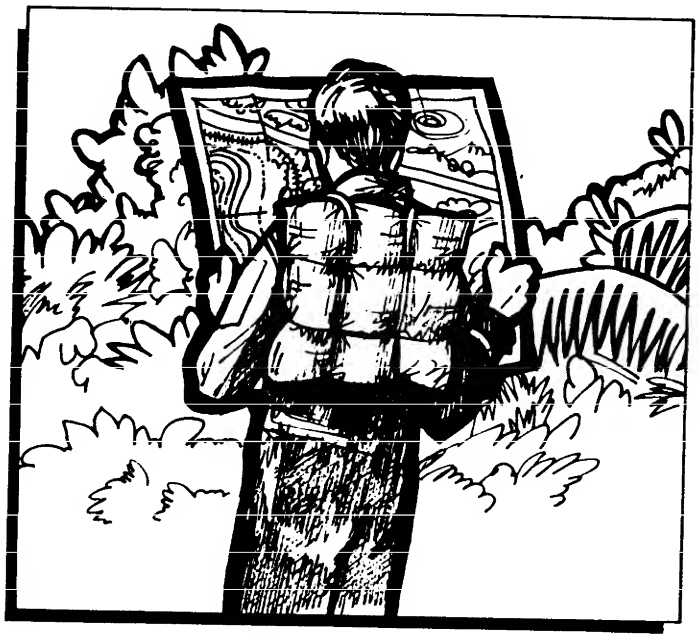


Figure 3-10. Travel.

(2) Survivors using rivers or streams for travel face both hazards and advantages as compared to overland travel. First, floating with the current is far less difficult than traveling overland. An abundance of food and water are usually readily available. Even in densely forested areas, effective signaling sites are generally available along streambeds. A survivor must use care and caution to avoid drowning, the most serious hazard associated with river travel.

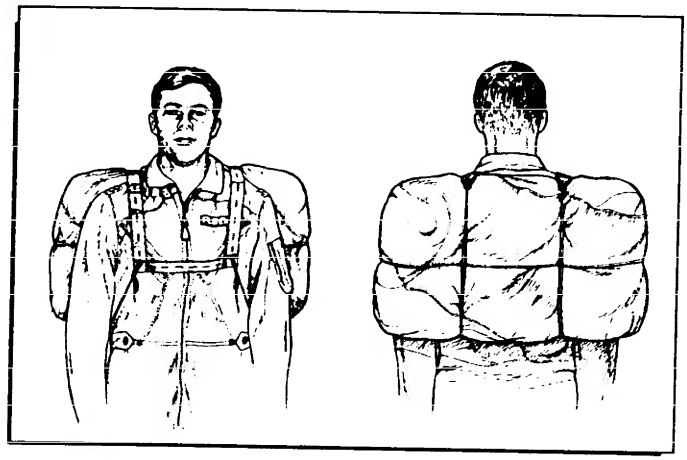


Figure 3-11. Burden Carrying.

Part Two

PSYCHOLOGICAL ASPECTS OF SURVIVAL

Chapter 4

CONTRIBUTING FACTORS

4-1. Introduction. Aircrew members in a survival situation must recognize that coping with the psychological aspects of survival are at least as important as handling the environmental factors. In virtually any survival episode, the aircrew will be in an environment that can support human life. The survivors' problems will be compounded because they never really expected to bail out or crash-land in the jungle, over the ocean, or anywhere else. No matter how well prepared, aircrews probably will never completely convince themselves that "it can happen to them." However, the records show it can happen. Before aircrew members learn about the physical aspects of survival, they must first understand that psychological problems may occur and that solutions to those problems must be found if the survival episode is to reach a successful conclusion (figure 4-1).

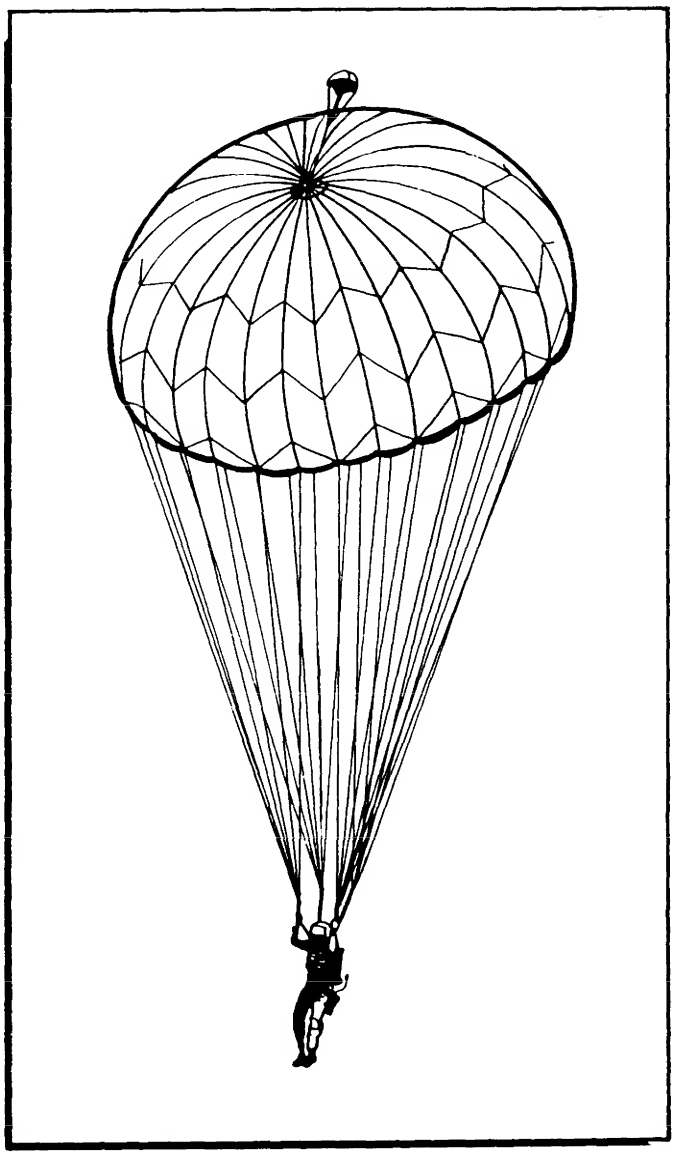


Figure 4-1. Psychological Aspects.

4-2. Survival Stresses:

a. The emotional aspects associated with survival must be completely understood just as survival conditions and equipment are understood. An important factor bearing on success or failure in a survival episode is the individual's psychological state. Maintaining an even, positive psychological state or outlook depends on the individual's ability to cope with many factors. Some include:

(1) Understanding how various physiological and emotional signs, feelings, and expressions affect one's bodily needs and mental attitude.

(2) Managing physical and emotional reactions to stressful situations.

(3) Knowing individual tolerance limits, both psychological and physical.

(4) Exerting a positive influence on companions.

b. Nature has endowed everyone with biological mechanisms which aid in adapting to stress. The bodily changes resulting from fear and anger, for example, tend to increase alertness and provide extra energy to either run away or fight. These and other mechanisms can hinder a person under survival conditions. For instance, a survivor in a raft could cast aside reason and drink sea water to quench a thrist; or, evaders in enemy territory, driven by hunger pangs, could expose themselves to capture when searching for food. These examples illustrate how "normal" reactions to stress could create problems for a survivor.

c. Two of the gravest threats to successful survival are concessions to comfort and apathy. Both threats represent attitudes which must be avoided. To survive, a person must focus planning and effort on fundamental needs.

(1) Many people consider comfort their greatest need. Yet, comfort is not essential to human survival. Survivors must value life more than comfort, and be willing to tolerate heat, hunger, dirt, itching, pain, and any other discomfort. Recognizing discomfort as tem-

Figure 4-2. Pain.

porary will help survivors concentrate on effective action.

(2) As the will to keep trying lessens, drowsiness, mental numbness, and indifference will result in apathy. This apathy usually builds on slowly, but ultimately takes over and leaves a survivor helpless. Physical factors can contribute to apathy. Exhaustion due to prolonged exposure to the elements, loss of body fluids (dehydration), fatigue, weakness, or injury are all conditions which can contribute to apathy. Proper planning and sound decisions can help a survivor avoid these conditions. Finally, survivors must watch for signs of apathy in companions and help prevent it. The first signs are resignation, quietness, lack of communication, loss of appetite, and withdrawal from the group. Preventive measures could include maintaining group morale by planning, activity, and getting the organized participation of all members.

d. Many common stresses cause reactions which can be recognized and dealt with appropriately in survival situations. A survivor must understand that stresses and reactions often occur at the same time. Although survivors will face many stresses, the following common stresses will occur in virtually all survival episodes: pain, thirst, cold and heat, hunger, frustration, fatigue, sleep deprivation, isolation, insecurity, loss of self-esteem, loss of self-determination, and depression.

4-3. Pain:

a. Pain, like fever, is a warning signal calling attention to an injury or damage to some part of the body. Pain is discomforting but is not, in itself, harmful or dangerous. Pain can be controlled, and in an extremely grave situation, survival must take priority over giving in to pain (figure 4-2).

b. The biological function of pain is to protect an injured part by warning the individual to rest it or avoid using it. In a survival situation, the normal pain warnings may have to be ignored in order to meet more critical needs. People have been known to complete a fight with a fractured hand, to run on a fractured or sprained ankle, to land an aircraft despite severely burned hands, and to ignore pain during periods of intense concentration and determined effort. Concentration and intense effort can actually stop or reduce feelings of pain. Sometimes this concentration may be all that is needed to survive.

c. A survivor must understand the following facts about pain:

(1) Despite pain, a survivor can move in order to live.

(2) Pain can be reduced by:

(a) Understanding its source and nature.

(b) Recognizing pain as a discomfort to be tolerated.

(c) Concentrating on necessities like thinking, planning, and keeping busy.

(d) Developing confidence and self-respect. When personal goals are maintaining life, honor, and returning, and these goals are valued highly enough, a survivor can tolerate almost anything.

4-4. Thirst and Dehydration:

a. The lack of water and its accompanying problems of thirst and dehydration are among the most critical problems facing survivors. Thirst, like fear and pain, can be tolerated if the will to carry on, supported by calm, purposeful activity, is strong. Although thirst indicates the body's need for water, it does not indicate how much water is needed. If a person drinks only enough to satisfy thirst, it is still possible to slowly dehydrate. Prevention of thirst and the more debilitating dehydration is possible if survivors drink plenty of water any time it is available, and especially when eating (figure 4-3).

b. When the body's water balance is not maintained, thirst and discomfort result. Ultimately, a water imbalance will result in dehydration. The need for water may be increased if the person:

(1) Has a fever.

(2) Is fearful.

(3) Perspires unnecessarily.

(4) Rations water rather than sweat.

c. Dehydration decreases the body's efficiency or ability to function. Minor degrees of dehydration may not noticeably affect a survivor's performance, but as it becomes more severe, body functioning will become increasingly impaired. Slight dehydration and thirst can

Figure 4-3. Thirst.

also cause irrational behavior. One survivor described it:

> "The next thing I remember was being awakened by an unforgettable sensation of thirst. I began to move about aimlessly and finally found a pool of water."
>
> "We finally found water. In the water were two dead deer with horns locked. We went down to the water and drank away. It was the best damned drink of water I ever had in my life. I didn't taste the stench of the deer at all."

While prevention is the best way to avoid dehydration, virtually any degree of dehydration is reversible simply by drinking water.

4-5. Cold and Heat. The average normal body temperature for a person is 98.6°F. Victims have survived a body temperature as low as 20°F below normal, but consciousness is clouded and thinking numbed at a much smaller drop. An increase of 6 to 8 degrees above normal for any prolonged period may prove fatal. Any deviation from normal temperature, even as little as 1 or 2 degrees, reduces efficiency.

a. Cold is a serious stress since even in mild degrees it lowers efficiency. Extreme cold numbs the mind and dulls the will to do anything except get warm again. Cold numbs the body by lowering the flow of blood to the extremities, and results in sleepiness. Survivors have endured prolonged cold and dampness through exercise, proper hygiene procedures, shelter, and food. Wearing proper clothing and having the proper climatic survival equipment when flying in cold weather areas are essential to enhance survivability (figure 4-4).

(1) One survivor described cold and its effect:

> "Because of the cold water, my energy was going rapidly and all I could do was to hook my left arm over one side of the raft, hang on, and watch the low flying planes as they buzzed me...As time progressed, the numbing increased...and even seemed to impair my thinking."

(2) Another survivor remembered survival training and acted accordingly:

> "About this time, my feet began getting cold. I remembered part of the briefing I had received about feet freezing so I immediately took action. I thought about my shoes, and with my jack knife, cut off the bottom of my Mark II immersion suit and put them over my shoes. My feet immediately felt warmer and the rubber feet of the immersion suit kept the soles of my shoes dry."

b. Just as "numbness" is the principal symptom of cold, "weakness" is the principle symptom of heat. Most people can adjust to high temperatures, whether in the hold of a ship or in a harvest field on the Kansas prairie. It may take from 2 days to a week before circulation, breathing, heart action, and sweat glands are all adjusted to a hot climate. Heat stress also accentuates dehydration, which was discussed earlier. In addition to the problem of water, there are many other sources of discomfort and impaired efficiency which are directly attributable to heat or to the environmental conditions in hot climates. Extreme temperature changes, from extremely hot days to very cold nights, are experienced in desert and plains areas. Proper use of clothing and shelters can decrease the adverse effects of such extremes (figure 4-5).

c. Bright sun has a tremendous effect on eyes and any exposed skin. Direct sunlight or rays reflecting off the terrain require dark glasses or improvised eye protec-

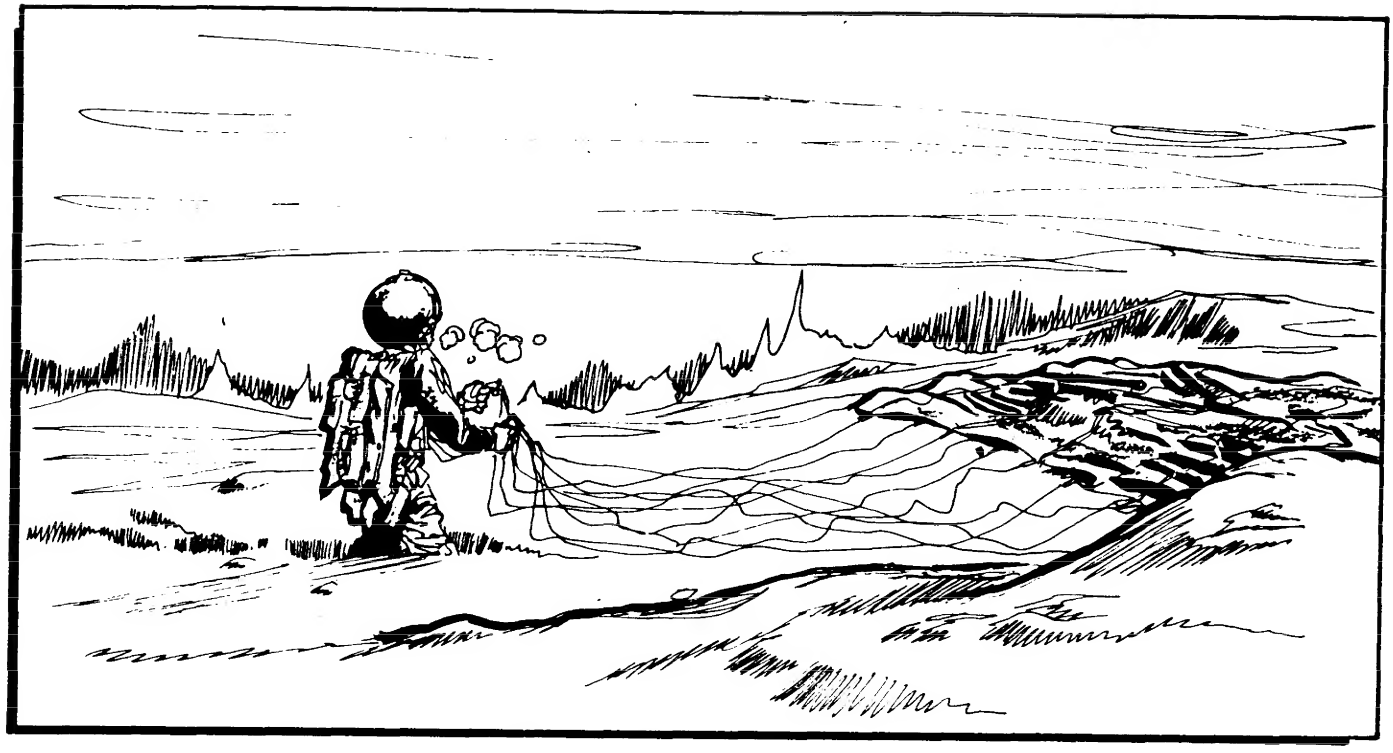


Figure 4-4. Cold.

tors. Previous suntanning provides little protection; protective clothing is important.

d. Blowing wind, in hot summer, has been reported to get on some survivors' nerves. Wind can constitute an additional source of discomfort and difficulty in desert areas when it carries particles of sand and dirt. Protection against sand and dirt can be provided by tying a cloth around the head after cutting slits for vision.

Figure 4-5. Heat.

e. Acute fear has been experienced among survivors in sandstorms and snowstorms. This fear results from both the terrific impact of the storm itself and its obliteration of landmarks showing direction of travel. Finding or improving shelter for protection from the storm itself is important.

f. Loss of moisture, drying of the mouth and mucous membranes, and accelerate dehydration can be caused by breathing through the mouth and talking. Survivors must learn to keep their mouths shut in desert winds as well as in cold weather.

g. Mirages and illusions of many kinds are common in desert areas. These illusions not only distort visual perception but sometimes account for serious incidents. In the desert, distances are usually greater than they appear and, under certain conditions, mirages obstruct accurate vision. Inverted reflections are a common occurrence.

4-6. Hunger. A considerable amount of edible material (which survivors may not initially regard as food) may be available under survival conditions. Hunger and semistarvation are more commonly experienced among survivors than thirst and dehydration. Research has revealed no evidence of permanent damage nor any decrease in mental efficiency from short periods of total fasting (figure 4-6).

Figure 4-6. Hunger.

a. The prolonged and rigorous Minnesota semistarvation studies during World War II revealed the following behavioral changes:

(1) Dominance of the hunger drive over other drives.

(2) Lack of spontaneous activity.

(3) Tired and weak feeling.

(4) Inability to do physical tasks.

(5) Dislike of being touched or caressed in any way.

(6) Quick susceptibility to cold.

(7) Dullness of all emotional responses (fear, shame, love, etc.)

(8) Lack of interest in others—apathy.

(9) Dullness and boredom.

(10) Limited patience and self-control.

(11) Lack of a sense of humor.

(12) Moodiness—reaction of resignation.

b. Frequently, in the excitement of some survival, evasion, and escape episodes, hunger is forgotten. Survivors have gone for considerable lengths of time without food or awareness of hunger pains. An early effort should be made to procure and consume food to reduce the stresses brought on by food deprivation. Both the physical and psychological effects described are reversed when food and a protective environment are restored. Return to normal is slow and the time necessary for the return increases with the severity of starvation. If food deprivation is complete and only water is ingested, the pangs of hunger disappear in a few days, but even then the mood changes of depression and irritability occur. The individual tendency is still to search for food to prevent starvation and such efforts might continue as long as strength and self-control permit. When the food supply is limited, even strong friendships are threatened.

c. Food aversion may result in hunger. Adverse group opinion may discourage those who might try foods unfamiliar to them. In some groups, the barrier would be broken by someone eating the particular food rather than starving. The solitary individual has only personal prejudices to overcome and will often try strange foods.

d. Controlling hunger during survival episodes is relatively easy if the survivor can adjust to discomfort and adapt to primitive conditions. This man would rather survive than be fussy:

> "Some men would almost starve before eating the food. There was a soup made of lamb's head with the lamb's eyes floating around in it....When there was a new prisoner, I would try to find a seat next to him so I could eat the food he refused."

4-7. Frustration. Frustration occurs when one's efforts are stopped, either by obstacles blocking progress toward a goal or by not having a realistic goal. It can also occur if the feeling of self-worth or self-respect is lost (figure 4-7).

a. A wide range of obstacles, both environmental and internal, can lead to frustration. Frustrating conditions often create anger, accompanied by a tendency to attack and remove the obstacles to goals.

b. Frustration must be controlled by channeling energies into a positive and worthwhile obtainable goal. The survivor should complete the easier tasks before attempting more challenging ones. This will not only instill self-confidence, but also relieve frustration.

4-8. Fatigue. In a survival episode, a survivor must continually cope with fatigue and avoid the accompanying strain and loss of efficiency. A survivor must be aware of the dangers of over-exertion. In many cases, a survivor may already be experiencing strain and reduced efficiency as a result of other stresses such as heat or cold, dehydration, hunger, or fear. A survivor must judge capacity to walk, carry, lift, or do necessary work, and plan and act accordingly. During an emergency, considerable exertion may be necessary to cope with the situation. If an individual understands fatigue and the attitudes and feelings generated by various kinds of effort, that individual should be able to call on available reserves of energy when they are needed (figure 4-8).

a. A survivor must avoid complete exhaustion which may lead to physical and psychological changes. A survivor should be able to distinguish between exhaustion and being uncomfortably tired. Although a person

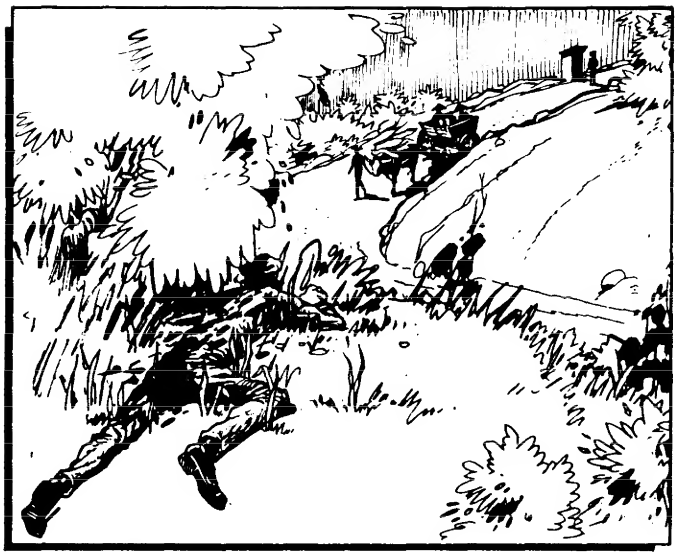


Figure 4-7. Frustration.

should avoid working to complete exhaustion, in emergencies certain tasks must be done in spite of fatigue.

(1) Rest is a basic factor for recovery from fatigue and is also important in resisting further fatigue. It is

Figure 4-8. Fatigue.

essential that the rest (following fatiguing effort) be sufficient to permit complete recovery; otherwise, the residual fatigue will accumulate and require longer periods of rest to recover from subsequent effort. During the early stages of fatigue proper rest provides a rapid recovery. This is true of muscular fatigue as well as mental fatigue. Sleep is the most complete form of rest available and is basic to recovery from fatigue.

(2) Short rest breaks during extended stress periods can improve total output. There are five ways in which rest breaks are beneficial:

(a) They provide opportunities for partial recovery from fatigue.

(b) They help reduce energy expenditure.

(c) They increase efficiency by enabling a person to take maximum advantage of planned rest.

(d) They relieve boredom by breaking up the uniformity and monotony of the task.

(e) They increase morale and motivation.

(3) Survivors should rest before output shows a definite decline. If rest breaks are longer, fewer may be required. When efforts are highly strenuous or monotonous, rest breaks should be more frequent. Rest breaks providing relaxation are the most effective. In mental work, mild exercise may be more relaxing. When work is monotonous, changes of activity, conversation, and humor are effective relaxants. In deciding on the amount and frequency of rest periods, the loss of efficiency resulting from longer hours of effort must be weighed against the absolute requirements of the survival situation.

(4) Fatigue can be reduced by working "smarter." A survivor can do this in two practical ways:

(a) Adjust the pace of the effort. Balance the load, the rate, and the time period. For example, walking at a normal rate is a more economical effort than fast walking.

(b) Adjust the technique of work. The way in which work is done has a great bearing on reducing fatigue. Economy of effort is most important. Rhythmic movements suited to the task are best.

(5) Mutual group support, cooperation, and competent leadership are important factors in maintaining group morale and efficiency, thereby reducing stress and fatigue. A survivor usually feels tired and weary before the physiological limit is reached. In addition, other stresses experienced at the same time; such as cold, hunger, fear, or despair, can intensify fatigue. The feeling of fatigue involves not only the physical reaction to effort, but also subtle changes in attitudes and motivation. Remember, a person has reserves of energy to cope with an important emergency even when feeling very tired.

b. As in the case of other stresses, even a moderate amount of fatigue reduces efficiency. To control fatigue, it is wise to observe a program of periodic rest. Because the main objective—to establish contact with friendly forces—survivors may overestimate their strength and risk exhaustion. On the other hand, neither an isolated individual nor a group leader should underestimate the capacity of the individual or the group on the basis of fatigue. The only sound basis for judgment must be gained from training and past experience. In training, a person should form an opinion of individual capacity based on actual experience. Likewise, a group leader must form an opinion of the capacities of fellow aircrew members. This group didn't think:

"By nightfall, we were completely bushed ... We decided to wrap ourselves in the 'chute instead of making a shelter. We were too tired even to build a fire. We just cut some pine boughs, rolled ourselves in the nylon and went to sleep...and so, of course, it rained, and not lightly. We stood it until we were soaked, and then we struggled out and made a shelter. Since it was pitch dark, we didn't get the sags out of the canopy, so the water didn't all run off. Just a hell of a lot of it came through. Our hip and leg joints ached as though we had acute rheumatism. Being wet and cold accentuated the pain. We changed positions every 10 minutes, after gritting our teeth to stay put that long."

4-9. Sleep Deprivation. The effects of sleep loss are closely related to those of fatigue. Sleeping at unaccustomed times, sleeping under strange circumstances (in a strange place, in noise, in light, or in other distractions), or missing part or all of the accustomed amount of sleep will cause a person to react with feelings of weariness, irritability, emotion tension, and some loss of efficiency. The extent of an individual's reaction depends on the amount of disturbance and on other stress factors which may be present at the same time (figure 4-9).

a. Strong motivation is one of the principal factors in helping to compensate for the impairing effects of sleep loss. Superior physic and mental conditioning, opportunities to rest, food and water, and companions help in enduring sleep deprivation. If a person is in reasonably good physical and mental condition, sleep deprivation can be endured 5 days or more without damage, although efficiency during the latter stages may be poor. A person must learn to get as much sleep and rest as possible. Restorative effects of sleep are felt even after "catnaps." In some instances, survivors may need to stay awake. Activity, movement, conversation, eating, and drinking are some of the ways a person can stimulate the body to stay awake.

b. When one is deprived of sleep, sleepiness usually comes in waves. A person may suddenly be sleepy immediately after a period of feeling wide awake. If this can be controlled, the feeling will soon pass and the person will be wide awake again until the next wave appears. As the duration of sleep deprivation increases, these periods between waves of sleepiness become shorter. The need to sleep may be so strong in some people after a long period of deprivation that they become desperate and do careless or dangerous things in order to escape this stress.

Figure 4-9. Sleep Deprivation.

4-10. Isolation. Loneliness, helplessness, and despair which are experienced by survivors when they are isolated are among the most severe survival stresses. People often take their associations with family, friends, military collegues, and others for granted. But survivors soon begin to miss the daily interaction with other people. However, these, like the other stresses already discussed, can be conquered. Isolation can be controlled and overcome by knowledge, understanding, deliberate countermeasures, and a determined will to resist it (figure 4-10).

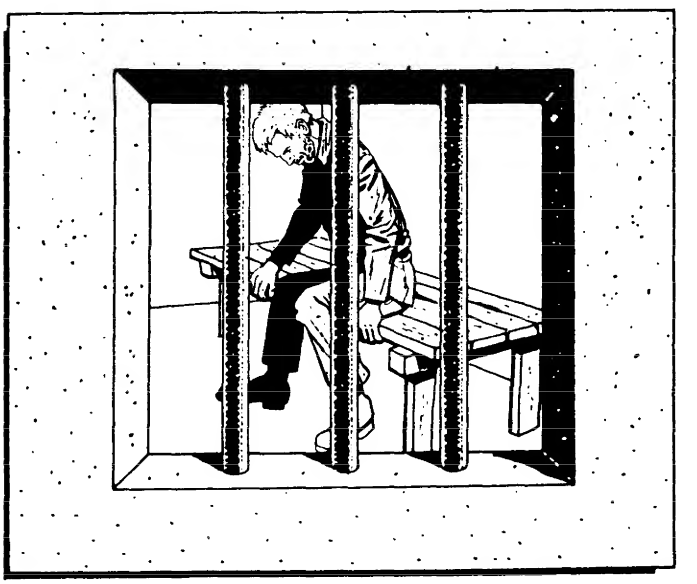


Figure 4-10. Isolation.

4-11. Insecurity. Insecurity is the survivor's feeling of helplessness or inadequacy resulting from varied stresses and anxieties. These anxieties may be caused by uncertainty regarding individual goals, abilities, and the future in a survival situation. Feelings of insecurity may

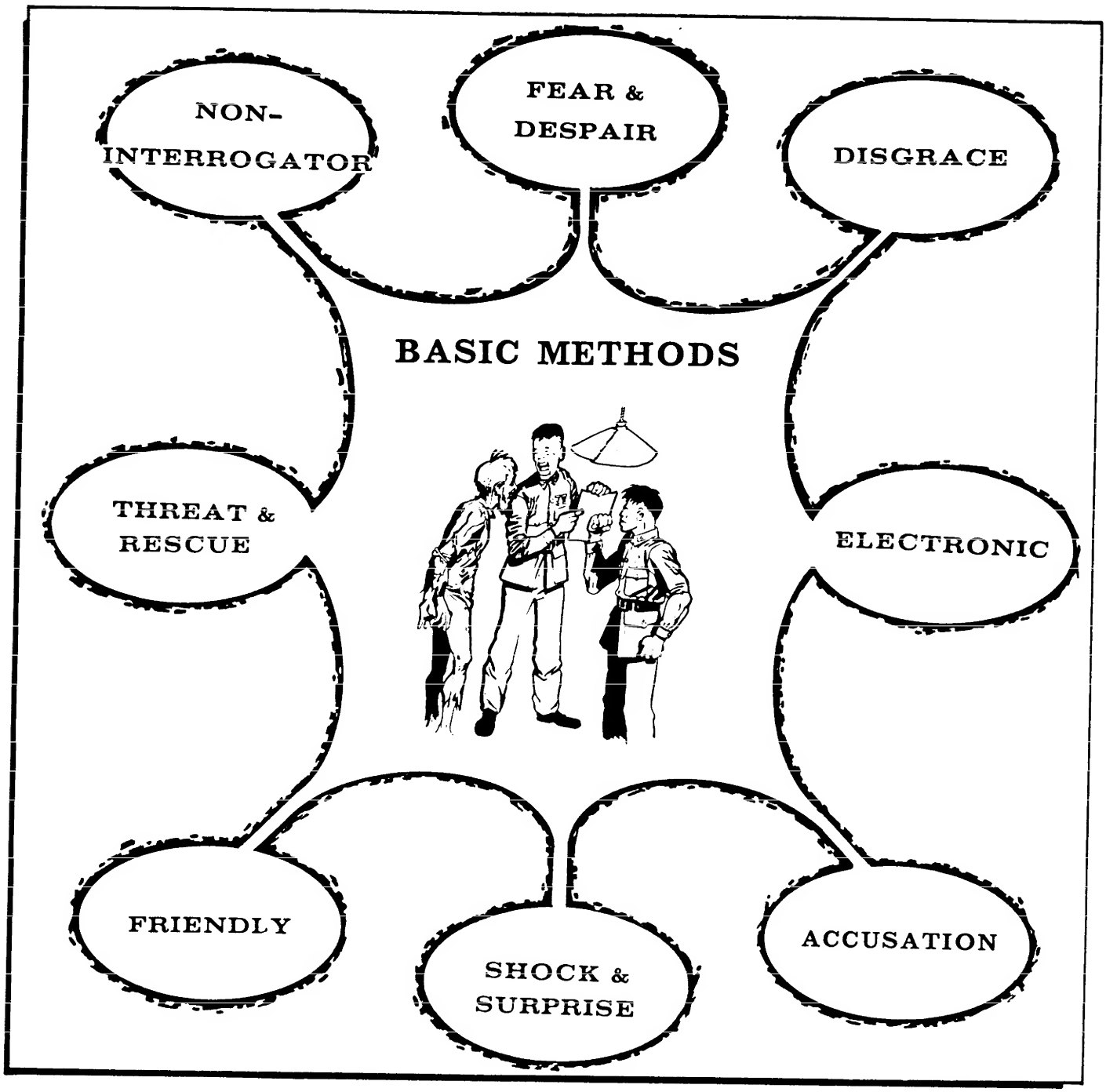


Figure 4-11. Loss of Self-Esteem.

have widely different effects on the survivor's behavior. A survivor should establish challenging but attainable goals. The better a survivor feels about individual abilities to achieve goals and adequately meet personal needs, the less insecure the survivor will feel.

4-12. Loss of Self-Esteem. Self-esteem is the state or quality of having personal self-respect and pride. Lack of (or loss of) self-esteem in a survivor may bring on depression and a change in perspective and goals. A loss of self-esteem may occur in individuals in captivity. Humiliation and other factors brought on by the captor may cause them to doubt their own worth. Humiliation comes from the feeling of losing pride or self-respect by being disgraced or dishonored, and is associated with the loss of self-esteem. Prisoners must maintain their pride and not become ashamed either because they are PWs or because of the things that happen to them as a

result of being a PW. The survivor who "loses face" (both personally and with the enemy) becomes more vulnerable to captor exploitation attempts. To solve this problem, survivors should try to maintain proper perspective about both the situation and themselves. Their feelings of self-worth may be bolstered if they recall the implied commitment in the Code of Conduct—PWs will not be forgotten (figure 4-11).

4-13. Loss of Self-Determination. A self-determined person is relatively free from external controls or influences over his or her actions. In everyday society, these "controls and influences" are the laws and customs of our society and of the self-imposed elements of our personalities. In a survival situation, the "controls and influences" can be very different. Survivors may feel as if events, circumstances, and (in some cases) other people, are in control of the situation. Some factors which may cause individuals to feel they have lost the power of self-determination are a harsh captor, captivity, bad weather, or rescue forces that make time or movement demands. This lack of self-determination is more perceived than actual. Survivors must decide how unpleasant factors will be allowed to affect their mental state. They must have the self-confidence, fostered by experience and training, to live with their feelings and decisions, and to accept responsibility for both the way they feel and how they let those feelings affect them.

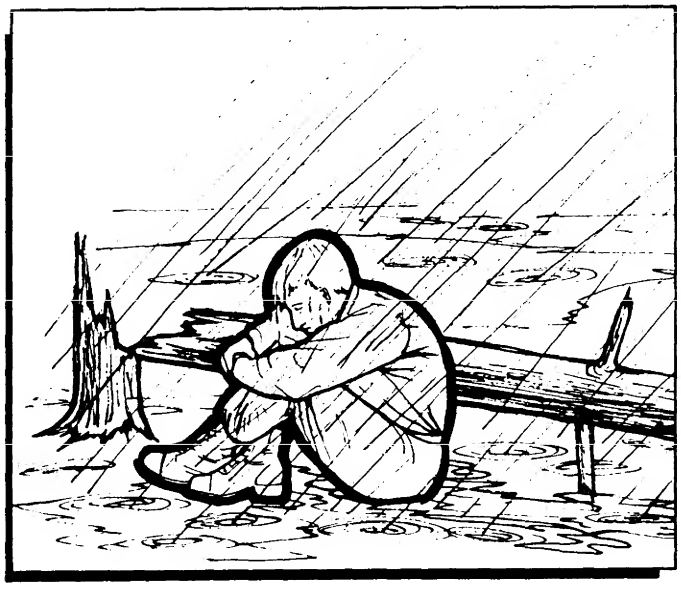


Figure 4-12. Depression.

4-14. Depression. As a survivor, depression is the biggest psychological problem that has to be conquered. It should be acknowledged that everyone has mental "highs" as well as mental "lows." People experiencing long periods of sadness or other negative feelings are suffering from depression. A normal mood associated with the sadness, grief, disappointment, or loneliness that everyone experiences at times is also described as depression. Most of the emotional changes in mood are temporary and do not become chronic. Depressed survivors may feel fearful, guilty, or helpless. They may lose interest in the basic needs of life. Many cases of depression also involve pain, fatigue, loss of appetite, or other physical ailments. Some depressed survivors try to injure or kill themselves (figure 4-12).

a. Psychiatrists have several theories as to the cause of depression. Some feel a person who, in everyday life and under normal conditions, experiences many periods of depression would probably have a difficult time in a survival situation. The main reason depression is a most difficult problem is that it can affect a wide range of psychological responses. The factors can become mutually reinforcing. For example, fatigue may lead to a feeling of depression. Depression may increase the feeling of fatigue, and this, in turn, leads to deeper depression and so on.

b. Depression usually begins after a survivor has met the basic needs for sustaining life, such as water, shelter, and food. Once the survivor's basic needs are met, there is often too much time for that person to dwell on the past, the present predicament, and on future problems. The survivor must be aware of the necessity to keep the mind and body active to eliminate the feeling of depression. One way to keep busy (daily) is by checking and improving shelters, signals, and food supply.

Chapter 5

EMOTIONAL REACTIONS

5-1. Introduction. Survivors may depend more upon their emotional reactions to a situation than upon calm, careful analysis of potential danger—the enemy, the weather, the terrain, the nature of the in-flight emergency, etc. Whether they will panic from fear, or use it as a stimulant for greater sharpness, is more dependent on the survivor's reactions to the situation than on the situation itself. Although there are many reactions to stress, the following are the most common and will be discussed in detail: fear, anxiety, panic, hate, resentment, anger, impatience, dependency, loneliness, boredom, and hopelessness.

5-2. Fear. Fear can SAVE A LIFE—or it can COST ONE. Some people are at their best when they are scared. Many downed fliers faced with survival emergencies have been surprised at how well they remembered their training, how quickly they could think and react, and what strength they had. The experience gave them a new confidence in themselves. On the other hand, some people become paralyzed when faced with the simplest survival situation. Some of them have been able "to snap themselves out of it" before it was too late. In other cases, a fellow aircrew member was on hand to assist them. However, others have not been so fortunate. They are not listed among the survivors (figure 5-1).

Figure 5-1. Fear.

a. How a person will react to fear depends more upon the individual than it does upon the situation. This has been demonstrated both in actual survival situations and in laboratory experiments. It isn't always the physically strong or the happy-go-lucky people who handle fear most effectively. Timid and anxious people have met emergencies with remarkable coolness and strength.

b. Anyone who faces life-threatening emergencies experiences fear. Fear is conscious when it results from a recognized situation (such as an immediate prospect of bailout) or when experienced as apprehension of impending disaster. Fear also occurs at a subconscious level and creates feelings of uneasiness, general discomfort, worry, or depression. Fear may vary widely in intensity, duration, and frequency of occurrence, and affect behavior across the spectrum from mild uneasiness to complete disorganization and panic. People have many fears; some are learned through personal experiences, and others are deliberately taught to them. Fear in children is directed through negative learning, as they are taught to be afraid of the dark, of animals, of noise, or of teachers. These fears may control behavior, and a survivor may react to feelings and imagination rather than to the problem causing fear.

c. When fantasy distorts a moderate danger into a major catastrophe, or vice versa, behavior can become abnormal. There is a general tendency to underestimate and this leads to reckless, foolhardy behavior. The principal means of fighting fear (in this case) is to pretend that it does not exist. There are no sharp lines between recklessness and bravery. It is necessary to check behavior constantly to maintain proper control.

d. One or more of the following signs or symptoms may occur in those who are afraid. However, they may also appear in circumstances other than fear.

(1) Quickening of pulse; trembling.

(2) Dilation of pupils.

(3) Increased muscular tension and fatigue.

(4) Perspiration of palms of hands, soles of feet, and armpits.

(5) Dryness of mouth and throat; higher pitch of voice; stammering.

(6) Feeling of "butterflies in the stomach," emptiness of the stomach, faintness, and nausea.

e. Accompanying these physical symptoms are the following common psychological symptoms:

(1) Irritability; increased hostility.

(2) Talkativeness in early stages, leading finally to speechlessness.

(3) Confusion, forgetfulness, and inability to concentrate.

(4) Feelings of unreality, flight, panic, or stupor.

f. Throughout military history, many people have coped successfully with the most strenuous odds. In adapting to fear, they have found support in previous training and experience. There is no limit to human

control of fear. Survivors must take action to control fear. They cannot run away from fear. Appropriate actions should be to:

(1) Understand fear.

(2) Admit that it exists.

(3) Accept fear as reality.

g. Training can help survivors recognize what individual reactions may be. Using prior training, survivors should learn to think, plan, and act logically, even when afraid.

h. To effectively cope with fear, a survivor must:

(1) Develop confidence. Use training opportunities; increase capabilities by keeping physically and mentally fit; know what equipment is available and how to use it; learn as much as possible about all aspects of survival.

(2) Be prepared. Accept the possibility that "it can happen to me." Be properly equipped and clothed at all times; have a plan ready. Hope for the best, but be prepared to cope with the worst.

(3) Keep informed. Listen carefully and pay attention to all briefings. Know when danger threatens and be prepared if it comes; increase knowledge of survival environments to reduce the "unknown."

(4) Keep busy at all times. Prevent hunger, thirst, fatigue, idleness, and ignorance about the situation, since these increase fear.

(5) Know how fellow crewmembers react to fear. Learn to work together in emergencies—to live, work, plan, and help each other as a team.

(6) Practice religion. Don't be ashamed of having spiritual faith.

(7) Cultivate "good" survival attitudes. Keep the mind on a main goal and keep everything else in perspective. Learn to tolerate discomfort. Don't exert energy to satisfy minor desires which may conflict with the overall goal—to survive.

(8) Cultivate mutual support. The greatest support under severe stress may come from a tightly knit group. Teamwork reduces fear while making the efforts of every person more effective.

(9) Exercise leadership. The most important test of leadership and perhaps its greatest value lies in the stress situation.

(10) Practice discipline. Attitudes and habits of discipline developed in training carry over into other situations. A disciplined group has a better chance of survival than an undisciplined group.

(11) Lead by example. Calm behavior and demonstration of control are contagious. Both reduce fear and inspire courage.

i. Every person has goals and desires. The greatest values exercise the greatest influence. Because of strong religious, moral, or patriotic values, people have been known to face torture and death calmly rather than reveal information or compromise a principle. Fear can kill or it can save lives. It is a normal reaction to danger. By understanding and controlling fear through training, knowledge, and effective group action, fear can be overcome.

5-3. Anxiety:

a. Anxiety is a universal human reaction. Its presence can be felt when changes occur which affect an individual's safety, plans, or methods of living. It is generally felt when individuals perceive something bad is about to happen. A common description of anxiety is "butterflies in the stomach." Anxiety creates feelings of uneasiness, general discomfort, worry, or depression. Anxiety and fear differ mainly in intensity. Anxiety is a milder reaction and the specific cause(s) may not be readily apparent, whereas fear is a strong reaction to a specific, known cause. Common characteristics of anxiety are: fear of the future, indecision, feelings of helplessness, resentment (figure 5-2).

Figure 5-2. Anxiety.

b. To overcome anxiety, the individual must take positive action by adopting a simple plan. It is essential to keep your mind off of your injuries and do something constructive. For example, one PW began to try and teach English to the Chinese and to learn Chinese from them.

5-4. Panic. In the face of danger, a person may panic or "freeze" and cease to function in an organized manner. A person experiencing panic may have no conscious control over individual actions. Uncontrollable, irrational behavior is common in emergency situations. Anybody can panic, but some people go to pieces more easily than others. Panic is brought on by a sudden overwhelming fear, and can often spread quickly through a group of people. Every effort must be made

to bolster morale and calm the panic with leadership and discipline. Panic has the same signs as fear and should be controlled in the same manner as fear. This survivor allowed pain to panic him.

> "His parachute caught in the tree, and he found himself suspended about five feet above the ground...one leg strap was released while he balanced in this aerial position and he immediately slipped toward the ground.

Figure 5-3. Panic.

> In doing so, his left leg caught in the webbing and he was suspended by one leg with his head down. Unfortunately, the pilot's head touched an ant hill and biting ants immediately swarmed over him. Apparently, in desperation, the flier pulled his gun and fired five rounds into the webbing holding his foot. When he did not succeed in breaking the harness by shooting at it, he placed the last shot in his head and thus took his own life. It was obvious from the discoverer's report that if the pilot had even tried to turn around or to swing himself from his inverted position, he could have reached either the aerial roots or the latticed trunk of the tree. With these branches, he should have been able to pull himself from the harness...The fact that his head was in a nest of stinging ants only added to his panic, which led to the action that took his life." (Figure 5-3)

5-5. Hate. Hate—feelings of intense dislike, extreme aversion, or hostility—is a powerful emotion which can have both positive and negative effects on a survivor. An understanding of the emotion and its causes is the key to learning to control it. Hate is an acquired emotion rooted in a person's knowledge or perceptions. The accuracy or inaccuracy of the information is irrelevant to learning to hate.

a. Any person, any object, or anything that may be understood intellectually, such as political concepts or religious dogma, can promote feelings of hate. Feelings of hate (usually accompanied with a desire for vengence, revenge, or retribution) have sustained former prisoners of war through their harsh ordeals. If an individual loses perspective while under the influence of hate and reacts emotionally, rational solutions to problems may be overlooked, and the survivor may be endangered.

b. To effectively deal with this emotional reaction, the survivor must first examine the reasons why the feeling of hate is present. Once that has been determined, survivors should then decide what to do about those feelings. Whatever approach is selected, it should be as constructive as possible. Survivors must not allow hate to control them.

5-6. Resentment. Resentment is the experiencing of an emotional state of displeasure or indignation toward some act, remark, or person that has been regarded as causing personal insult or injury. Luck and fate may play a role in any survival situation. A hapless survivor may feel jealous resentment toward a fellow PW, travel partner, etc., if that other person is perceived to be enjoying a success or advantage not presently experienced by the observer. The survivor must understand that events cannot always go as expected. It is detrimental to morale and could affect survival chances if feelings of resentment over another's attainments become too strong. Imagined slights or insults are common. The survivor should try to maintain a sense of humor and perspective about ongoing events and realize that stress and lack of self-confidence play roles in bringing on feelings of resentment.

5-7. Anger. Anger is a strong feeling of displeasure and belligerence aroused by a real or supposed wrong. People become angry when they cannot fulfill a basic need

or desire which seems important to them. When anger is not relieved, it may turn into a more enduring attitude of hostility, characterized by a desire to hurt or destroy the person or thing causing the frustration. When anger is intense, the survivor loses control over the situation, resulting in impulsive behavior which may be destructive in nature. Anger is a normal response which can serve a useful purpose when carefully controlled. If the situation warrants and there is no threat to survival, one could yell or scream, take a walk, do some vigorous exercise, or just get away from the source of the anger, even if only for a few minutes. Here is a man who couldn't hold it.

> "I tried patiently to operate it (radio) in every way I had been shown. Growing more angry and disappointed at its failure, I tore the aerial off, threw the cord away, beat the battery on the rocks, then threw the pieces all over the hillside. I was sure disappointed." (See figure 5-4.)

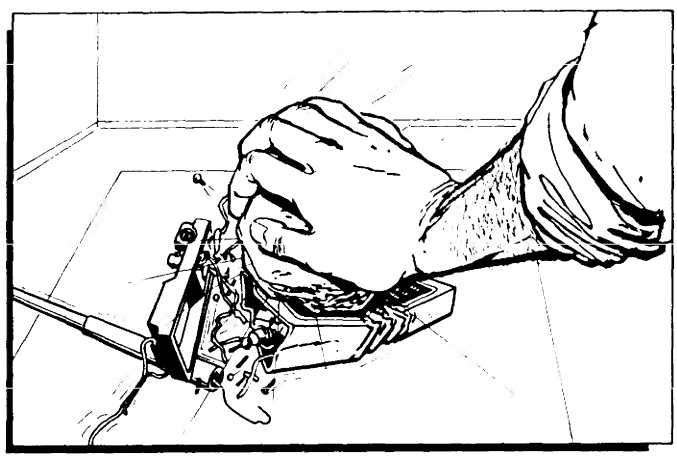


Figure 5-4. Anger.

5-8. Impatience:

a. The psychological stresses brought about by feelings of impatience can quickly manifest themselves in physical ways. Internally, the effects of impatience can cause changes in physical and mental well-being. Survivors who allow impatience to control their behavior may find that their efforts prove to be counterproductive and possibly dangerous. For example, evaders who don't have the ability or willingness to suppress annoyance when confronted with delay may expose themselves to capture or injury.

b. Potential survivors must understand they have to bear pain, misfortune, and annoyance without complaint. In the past, many survivors have displayed tremendous endurance, both mental and physical, in times of distress or misfortune. While not every survivor will be able to display such strength of character in all situations, each person should learn to recognize the things which may make them impatient to avoid acting unwisely. This survivor couldn't wait:

> "I became very impatient. I had planned to wait until night to travel but I just couldn't wait. I left the ditch about noon and walked for about two hours until I was caught."

5-9. Dependence. The captivity environment is the prime area where a survivor may experience feelings of dependency. The captor will try to develop in prisoners feelings of need, support, and trust for the captor. By regulating the availability of basic needs like food, water, clothing, social contact, and medical care, captors show their power and control over the prisoners' fate. Through emphasis on the prisoners' inability to meet their own basic needs, captors seek to establish strong feelings of prisoner dependency. This dependency can make prisoners extremely vulnerable to captor exploitation—a major captor objective. PW recognition of this captor tactic is key to countering it. Survivors must understand that, despite captor controls, they do control their own lives. Meeting even one physical or mental need can provide a PW with a "victory" and provide the foundation for continued resistance against exploitation (figure 5-5).

Figure 5-5. Dependence.

5-10. Loneliness. Loneliness can be very debilitating during a survival episode. Some people learn to control and manipulate their environment and become more self-sufficient while adapting to changes. Others rely on protective persons, routines, and familiarity of surroundings to function and obtain satisfaction (figure 5-6).

a. The ability to combat feelings of loneliness during a survival episode must be developed long before the episode occurs. Self-confidence and self-sufficiency are key factors in coping with loneliness. People develop these attributes by developing and demonstrating competence in performing tasks. As the degree of competence increases, so does self-confidence and self-sufficiency. Military training, more specifically survival training, is designed to provide individuals with the competence and self-sufficiency to cope with and adapt to survival living.

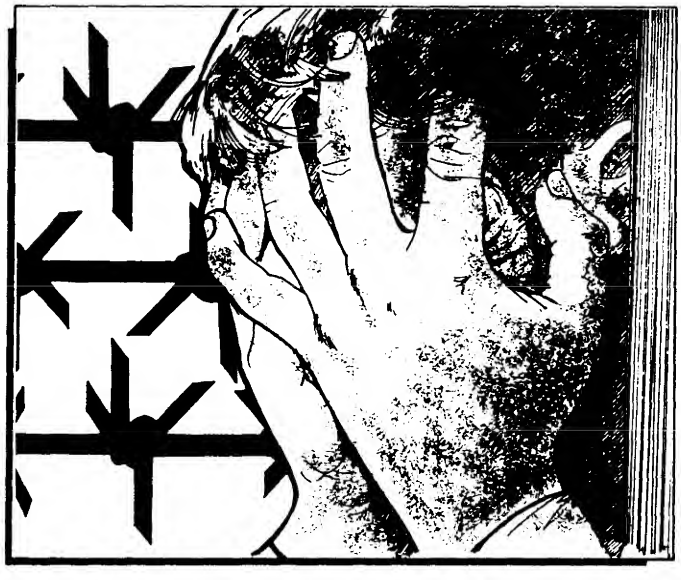


Figure 5-6. Loneliness.

b. In a survival situation, the countermeasure to conquer loneliness is to be active, to plan and think purposely. Development of self-sufficiency is the primary protection since all countermeasures in survival require the survivor to have the ability to practice self-control.

5-11. Boredom. Boredom and fatigue are related and frequently confused. Boredom is accompanied by a lack of interest and may include feelings of strain, anxiety, or depression, particularly when no relief is in sight and the person is frustrated. Relief from boredom must be based on correction of the two basic sources, repetitiveness and uniformity. Boredom can be relieved by a variation of methods—rotation of duties, broadening the scope of a particular task or job, taking rest breaks, or other techniques of diversification which may actually interfere with efficient performance of the job. The ungratifying nature of a task can be counteracted by clearing up its meaning, objectives, and, in some cases, its relation to the total plan.

a. This survivor couldn't think of anything to do:
"The underground representative took me to a house to wait for another member of the underground to pick me up. This was the worst part of the whole experience—this waiting. I just sat in the house and waited for two weeks. I thought I would go mad." (See figure 5-7.)

b. This survivor invented something to do:
"Not knowing what to do, I decided to kill all the bugs. There were a lot of spiders, the big ones that do not hurt humans, so I killed the flies and gave them to the spiders to eat."

Figure 5-7. Boredom.

5-12. Hopelessness. Hopelessness stems from negative feelings—regardless of actions taken, success is impossible, or the certainty that future events will turn out for the worst no matter what a person tries to do. Feelings of hopelessness can occur at virtually any time during a survival episode. Survivors have experienced loss of hope in trying to maintain health due to an inability to care for sickness, broken bones, or injuries; considering their chances of returning home alive; seeing their loved ones again; or believing in their physical or mental ability to deal with the situation; for example, evade long distances or not give information to an interrogator (figure 5-8).

Figure 5-8. Hopelessness.

a. During situations where physical exhaustion or exposure to the elements affects the mind, a person may begin to lose hope. The term "give-up-itis" was coined in Korea to describe the feeling of "hopelessness." During captivity, deaths occurred for no apparent cause. These individuals actually willed themselves to die or at least did not will themselves to live. The original premise (in the minds of such people) is that they are going to die. To them, the situation seemed totally futile and they had passively abandoned themselves to fate. It was possible to follow the process step by step. The people who died withdrew themselves from the group, became despondent, then lay down and gave up. In some cases, death followed rapidly.

b. One way to treat hopelessness is to eliminate the cause of the stress. Rest, comfort, and morale building activities can help eliminate this psychological problem. Another method used in Korea was to make the person so angry that the person wanted to get up and attack the tormentors. A positive attitude has a powerful influence on morale and combating the feeling of hopelessness.

c. Since many stress situations cannot be dealt with successfully by either withdrawal or direct attack, it may be necessary to work out a compromise solution. The action may entail changing a survivor's method of operation or accepting substitute goals.

d. Evaders faced with starvation may compromise with their conscience and steal "just this one time." They may ignore their food aversion and eat worms, bugs, or even human flesh. A related form of compromise is acceptance of substitute means to achieve the same goals.

5-13. Summary. All the psychological factors may be overcome by survivors if they can recognize the problem, work out alternative solutions, decide on an appropriate course of action, take action, and evaluate the results. Perhaps the most difficult step in this sequence is deciding on an appropriate course of action. Survivors may face either one or several psychological problems. These problems are quite dangerous and must be effectively controlled or countered for survival to continue.

Chapter 6

THE WILL TO SURVIVE

6-1. Introduction. The will to survive is defined as the desire to live despite seemingly insurmountable mental and(or) physical obstacles. The tools for survival are furnished by the military, the individual, and the environment. The training for survival comes from survival training publications, instruction, and the individual's own efforts. But tools and training are not enough without a *will to survive.* In fact, the records prove that "will" alone has been the deciding factor in many survival cases. While these accounts are not classic examples of "how to survive," they illustrate that a single-minded survivor with a powerful *will to survive* can overcome most hardships. There are cases where people have eaten their belts for nourishment, boiled water in their boots to drink as broth, or have eaten human flesh—though this certainly wasn't their cultural instinct.

a. One incident where the *will to survive* was the deciding factor between life and death involved a man stranded in the Arizona desert for 8 days without food and water. He traveled more than 150 miles during searing daytime temperatures, losing 25 percent of his body weight due to the lack of water (usually 10 percent loss causes death). His blood became so thick that the lacerations he received could not bleed until he had been rescued and received large quantities of water. When he started on that journey, something must have clicked in his mind telling him to live, regardless of any obstacles which might confront him. And live he did—on guts and will alone! (See figure 6-1.)

b. Let's flip a coin and check the other side of "will." Our location is the Canadian wilderness. A pilot ran into engine trouble and chose to deadstick his plane onto a frozen lake rather than punch out. He did a beautiful job and slid to a stop in the middle of the lake. He left the aircraft and examined it for damage. After surveying the area, he noticed a wooded shoreline only 200 yards away where food and shelter could be provided—he decided to go there. Approximately halfway there, he changed his mind and returned to the cockpit of his aircraft where he smoked a cigar, took out his pistol, and blew his brains out. Less than 24 hours later, a rescue team found him. Why did he give up? Why was he unable to survive? Why did he take his own life? On the other hand, why do people eat their belts or drink broth from their boots? No one really knows, but it's all related to the *will to survive.*

6-2. Overcoming Stress. The ability of the mind to overcome stress and hardship becomes most apparent when there appears to be little chance of a person surviving. When there appears to be no escape from the situation, the "will" enables a person to begin to win

Figure 6-1. Will to Survive.

"the battle of the mind." This mental attitude can bridge the gap between the crisis period and the coping period.

6-3. Crisis Period:

a. The crisis period is the point at which the person realizes the gravity of the situation and understands that the problem will not go away. At this stage, action is needed. Most people will experience shock in this stage as a result of not being ready to face this new challenge. Most will recover control of their faculties, especially if they have been prepared through knowledge and training.

b. Shock during a crisis is normally a response to being overcome with anxiety. Thinking will be disorganized. At this stage, direction will be required because the individual is being controlled by the environment. The person's center of control is external. In a group survival episode, a natural leader may appear who will direct and reassure the others. But if the situation continues to control the individual or the group, the response may be panic, behavior may be irrational, and judgment is impaired. In a lone-survivor episode, the individual must gain control of the situation and respond constructively. In either case, survivors must evaluate the situation and develop a plan of action.

During the evaluation, the survivor must determine the most critical needs to improve the chance of living and being rescued.

6-4. The Coping Period. The coping period begins after the survivor recognizes the gravity of the situation and resolves to endure it rather than succumb. The survivor must tolerate the effects of physical and emotional stresses. These stresses can cause anxiety which becomes the greatest obstacle to self-control and solving problems. Coping with the situation requires considerable internal control. For example, the survivor must often subdue urgent desires to travel when that would be counterproductive and dangerous. A person must have patience to sit in an emergency action shelter while confronted with an empty stomach, aching muscles, numb toes, and suppressed feelings of depression and hopelessness. Those who fail to think constructively may panic. This could begin a series of mistakes which result in further exhaustion, injury, and sometimes death. Death comes not from hunger pains but from the inability to manage or control emotions and thought processes.

6-5. Attitude. The survivor's attitude is the most important element of the *will to survive.* With the proper attitude, almost anything is possible. The desire to live is sometimes based on the feelings toward another person and(or) thing. Love and hatred are two emotional extremes which have moved people to do exceptional things physically and mentally. The lack of a *will to survive* can sometimes be identified by the individual's motivation to meet essential survival needs, emotional control resulting in reckless, paniclike behavior, and self-esteem.

a. It is essential to strengthen the *will to survive* during an emergency. The first step is to avoid a tendency to panic or "fly off the handle." Sit down, relax, and analyze the situation rationally. Once thoughts are collected and thinking is clear, the next step is to make decisions. In normal living, people can avoid decisions and let others do their planning. But in a survival situation, this will seldom work. Failure to decide on a course of action is actually a decision for inaction. This lack of decisionmaking may even result in death. However, decisiveness must be tempered with flexibility and planning for unforeseen circumstances. As an example, an aircrew member down in an arctic nontactical situation decides to construct a shelter for protection from the elements. The planning and actions must allow sufficient flexibility so the aircrew can monitor the area for indications of rescuers and be prepared to make contact—visually, electronically, etc.—with potential rescuers.

b. Tolerance is the next topic of concern. A survivor or evader will have to deal with many physical and psychological discomforts, such as unfamiliar animals, insects, loneliness, and depression. Aircrew members are trained to tolerate uncomfortable situations. That training must be applied to deal with the stress of environments.

c. Survivors in both tactical and nontactical situations must face and overcome fears to strengthen the *will to survive.* These fears may be founded or unfounded, be generated by the survivor's uncertainty or lack of confidence, or be based on the proximity of enemy forces. Indeed, fear may be caused by a wide variety of real and imagined dangers. Despite the source of the fear, survivors must recognize fear and make a conscious effort to overcome it.

6-6. Optimism. One of a survivor's key assets is optimism—hope and faith. Survivors must maintain a positive, optimistic outlook on their circumstance and how well they are doing. Prayer or meditation can be helpful. How a survivor maintains optimism is not so important as its use.

6-7. Summary. Survivors do not choose or welcome their fate and would escape it if they could. They are trapped in a world of seemingly total domination—a world hostile to life and any sign of dignity or resistance. The survival mission is not an easy one, but it is one in which success can be achieved. This has been an introduction to the concepts and ideas that can help an aircrew member return. Having the *will to survive* is what it's all about!

Part Three

BASIC SURVIVAL MEDICINE

Chapter 7

SURVIVAL MEDICINE

7-1. Introduction:

a. Foremost, among the many things which can compromise a survivor's ability to return are medical problems encountered during ejection, parachute descent, and(or) parachute landing. In the Southeast Asian conflict, some 30 percent of approximately 1,000 US Air Force survivors, including 322 returned PWs, were injured by the time they disentangled themselves from their parachutes. The most frequently reported injuries were fractures, strains, sprains, and dislocations, as well as burns and other types of wounds (figure 7-1).

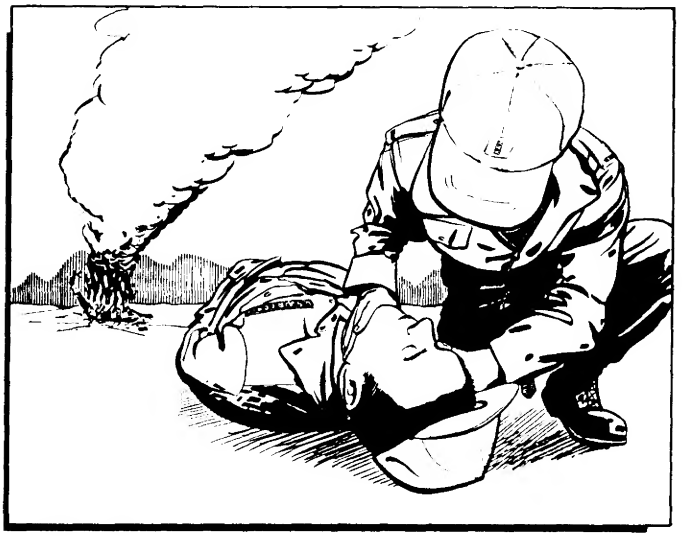


Figure 7-1. Survival Medicine.

b. Injuries and illnesses peculiar to certain environments can reduce survival expectancy. In cold climates, and often in an open sea survival situation, exposure to extreme cold can produce serious tissue trauma, such as frostbite, or death from hypothermia. Exposure to heat in warm climates, and in certain areas on the open seas, can produce heat cramps, heat exhaustion, or life-threatening heatstroke.

c. Illnesses contracted during evasion or in a captivity environment can interfere with successful survival. Among these are gastrointestinal disorders, respiratory diseases, skin infections and infestations, malaria, typhus, cholera, etc.

d. A review of the survival experiences from World War II, Korea, and Southeast Asia indicates that, while US military personnel generally knew how to administer first aid to others, there was a marked inability to administer self-aid. Further, only the most basic medical care had been taught to most military people. Lastly, it was repeatedly emphasized that even minor injuries or ailments, when ignored, became major problems in a survival situation. Thus, prompt attention to the most minor medical problem is essential in a survival episode. Applying principles of survival medicine should enable military members to maintain health and well-being in a hostile or nonhostile environment until rescued and returned to friendly control.

e. Information in this chapter and chapter 8 is a basic reference to self-aid techniques used by PWs in captivity and techniques found in folk medicine. The information describes procedures which can maintain health in medically austere situations. It includes items used to prevent and treat injuries and illnesses. Because there is no "typical" survival situation, the approach to self-aid must be flexible, placing emphasis on using what is available to treat the injury or illness. Further, survivors recognize that medical treatment offered by people of other cultures may be far different from our own. For example, in the rural areas of Vietnam, a poultice of python meat was and is used to treat internal lower back pain. Such treatment may be repugnant to some US military personnel; however, medical aid offered to survivors in non-US cultures may be the best available in the given circumstance.

f. The procedures in this chapter and chapter 8 must be viewed in the reality of a true survival situation. The results of treatment may be substandard compared with present medical standards. However, these procedures will not compromise professional medical care which becomes available following rescue. Moreover, in the context of a survival situation, they may represent the best available treatment to extend the individual's survival expectancy.

7-2. Procedures and Expedients. Survival medicine encompasses procedures and expedients that are:

a. Required and available for the preservation of health and the prevention, improvement, or treatment of injuries and illnesses encountered during survival.

b. Suitable for application by nonmedical personnel to themselves or comrades in the circumstances of the survival situation.

(1) Survival medicine is more than first aid in the conventional sense. It approaches final definitive treatment in that it is not dependent upon the availability of technical medical assistance within a reasonable period of time.

(2) To avoid duplication of information generally available, the basic principles of first aid will not be repeated, nor will the psychological factors affecting survival which were covered in part two.

7-3. Hygiene. In a survival situation, cleanliness is essential to prevent infection. Adequate personal cleanliness will not only protect against disease germs that are present in the individual's surroundings but will also protect the group by reducing the spread of these germs (figure 7-2).

Figure 7-2. Hygiene.

a. Washing, particularly the face, hands, and feet, reduces the chances of infection from small scratches and abrasions. A daily bath or shower with hot water and soap is ideal. If no tub or shower is available, the body should be cleaned with a cloth and soapy water, paying particular attention to the body creases (armpits, groin, etc.), face, ears, hands, and feet. After this type of "bath," the body should be rinsed thoroughly with clear water to remove all traces of soap which could cause irritation.

b. Soap, although an aid, is not essential to keeping clean. Ashes, sand, loamy soil, and other expedients may be used to clean the body and cooking utensils.

c. When water is in short supply, the survivor should take an "air bath." All clothing should be removed and the body simply exposed to the air. Exposure to sunshine is ideal, but even on an overcast day or indoors, a 2-hour exposure of the naked body to the air will refresh the body. Care should be taken to avoid sunburn when bathing in this manner. Exposure in the shade, shelter, sleeping bag, etc., will help if the weather conditions do not permit direct exposure.

d. Hair should be kept trimmed, preferably 2 inches or less in length, and the face should be clean-shaven. Hair provides a surface for the attachment of parasites and the growth of bacteria. Keeping the hair short and the face clean-shaven will provide less habitat for these organisms. At least once a week, the hair should be washed with soap and water. When water is in short supply, the hair should be combed or brushed thoroughly and covered to keep it clean. It should be inspected weekly for fleas, lice, and other parasites. When parasites are discovered, they should be removed.

e. The principal means of infecting food and open wounds is contact with unclean hands. Hands should be washed with soap and water, if available, after handling any material which is likely to carry germs. This is especially important after each visit to the latrine, when caring for the sick and injured, and before handling food, food utensils, or drinking water. The fingers should be kept out of the mouth and the fingernails kept closely trimmed and clean. A scratch from a long fingernail could develop into a serious infection.

7-4. Care of the Mouth and Teeth. Application of the following fundamentals of oral hygiene will prevent tooth decay and gum disease:

a. The mouth and teeth should be cleansed thoroughly with a toothbrush and dentifrice at least once each day. When a toothbrush is not available, a "chewing stick" can be fashioned from a twig. The twig is washed, then chewed on one end until it is frayed and brushlike. The teeth can then be brushed very thoroughly with the stick, taking care to clean all tooth surfaces. If necessary, a clean strip of cloth can be wrapped around the finger and rubbed on the teeth to wipe away food particles which have collected on them. When neither toothpaste nor toothpowder are available, salt, soap, or baking soda can be used as substitute dentifrices. Parachute inner core can be used by separating the filaments of the inner core and using this as a dental floss. Gargling with willow bark tea will help protect the teeth.

b. Food debris which has accumulated between the teeth should be removed by using dental floss or toothpicks. The latter can be fashioned from small twigs.

c. Gum tissues should be stimulated by rubbing them vigorously with a clean finger each day.

d. Use as much care cleaning dentures and other dental appliances, removable or fixed, as when cleaning natural teeth. Dentures and removable bridges should be removed and cleaned with a denture brush or "chew stick" at least once each day. The tissue under the dentures should be brushed or rubbed regularly for proper stimulation. Removable dental applicances should be

removed at night or for a 2- to 3-hour period during the day.

7-5. Care of the Feet. Proper care of the feet is of utmost importance in a survival situation, especially if the survivor has to travel. Serious foot trouble can be prevented by observing the following simple rules:

a. The feet should be washed, dried thoroughly, and massaged each day. If water is in short supply, the feet should be "air cleaned" along with the rest of the body (figure 7-3).

b. Toenails should be trimmed straight across to prevent the development of ingrown toenails.

c. Boots should be broken in before wearing them on *any* mission. They should fit properly, neither so tight that they bind and cause pressure spots nor so loose that they permit the foot to slide forward and backward when walking. Insoles should be improvised to reduce any friction spots inside the shoes.

Figure 7-3. Care of Feet.

d. Socks should be large enough to allow the toes to move freely but not so loose that they wrinkle. Wool socks should be at least one size larger than cotton socks to allow for shrinkage. Socks with holes should be properly darned before they are worn. Wearing socks with holes or socks that are poorly repaired may cause blisters. Clots of wool on the inside and outside should be removed from wool socks because they may cause blisters. Socks should be changed and washed thoroughly with soap and water each day. Woolen socks should be washed in cool water to lessen shrinkage. In camp, freshly laundered socks should be stretched to facilitate drying by hanging in the sun or in an air current. While traveling, a damp pair of socks can be dried by placing them inside layers of clothing or hanging them on the outside of the pack. If socks become damp, they should be exchanged for dry ones at the first opportunity.

e. When traveling, the feet should be examined regularly to see if there are any red spots or blisters. If detected in the early stages of development, tender areas should be covered with adhesive tape to prevent blister formation.

7-6. Clothing and Bedding. Clothing and bedding become contaminated with any disease germs which may be present on the skin, in the stool, in the urine, or in secretions of the nose and throat. Therefore, keeping clothing and bedding as clean as possible will decrease the chances of skin infection and decrease the possibility of parasite infestation. Outer clothing should be washed with soap and water when it becomes soiled. Under clothing and socks should be changed daily. If water is in short supply, clothing should be "air cleaned." For air cleaning, the clothing is shaken out of doors, then aired and sunned for 2 hours. Clothing cleaned in this manner should be worn in rotation. Sleeping bags should be turned inside out, fluffed, and aired after each use. Bed linen should be changed at least once a week, and the blankets, pillows, and mattresses should be aired and sunned (figure 7-4).

7-7. Rest. Rest is necessary for the survivor because it not only restores physical and mental vigor, but also promotes healing during an illness or after an injury.

a. In the initial stage of the survival episode, rest is particularly important. After those tasks requiring immediate attention are done, the survivor should inventory available resources, decide upon a plan of action, and even have a meal. This "planning session" will provide a rest period without the survivor having a feeling of "doing nothing."

b. If possible, regular rest periods should be planned in each day's activities. The amount of time allotted for rest will depend on a number of factors, including the survivor's physical condition, the presence of hostile forces, etc., but usually, 10 minutes each hour is sufficient. During these rest periods, the survivor should change either from physical activity to complete rest or from mental activity to physical activity as the case may be. The survivor must learn to become comfortable and to rest under less than ideal conditions.

Figure 7-4. Bedding.

7-8. Rules for Avoiding Illness. In a survival situation, whether short-term or long-term, the dangers of disease are multiplied. Application of the following simple guidelines regarding personal hygiene will enable the survivor to safeguard personal health and the health of others:

a. ALL water obtained from natural sources should be purified before consumption.

b. The ground in the camp area should not be soiled with urine or feces. Latrines should be used, if available. When no latrines are available, individuals should dig "cat holes" and cover their waste.

c. Fingers and other contaminated objects should never be put into the mouth. Hands should be washed before handling any food or drinking water, before using the fingers in the care of the mouth and teeth, before and after caring for the sick and injured, and after handling any material likely to carry disease germs.

d. After each meal, all eating utensils should be cleaned and disinfected in boiling water.

e. The mouth and teeth should be cleansed thoroughly at least once each day. Most dental problems associated with long-term survival episodes can be prevented by using a toothbrush and toothpaste to remove accumulated food debris. If necessary, devices for cleaning the teeth should be improvised.

f. Bites and insects can be avoided by keeping the body clean, by wearing proper protective clothing, and by using head net, improvised bed nets, and insect repellants.

g. Wet clothing should be exchanged for dry clothing as soon as possible to avoid unnecessary body heat loss.

h. Personal items such as canteens, pipes, towels, toothbrushes, handkerchiefs, and shaving items should not be shared with others.

i. All food scraps, cans, and refuse should be removed from the camp area and buried.

j. If possible, a survivor should get 7 or 8 hours of sleep each night.

k. Aircrew members should keep all immunization "shots" current.

7-9. General Management of Injuries:

a. Bleeding. Control of bleeding is most important in survival situations where replacement transfusions are not possible. Immediate steps should be taken to stop the flow of blood, regardless of its source. The method used should be commensurate with the type and degree of bleeding. The tourniquet, when required and properly used, will save life. If improperly used, it may cost the life of the survivor. The basic characteristics of a tourniquet and the methods of its use are well covered in standard first aid texts; however, certain points merit emphasis in the survival situation. A tourniquet should be used only after every alternate method has been attempted. If unable to get to medical aid within 2 hours, after 20 minutes, gradually loosen the tourniquet. If bleeding has stopped, remove the tourniquet; if bleeding continues, reapply and leave in place. The tourniquet should be applied as near the site of the bleeding as possible, between the wound and the heart, to reduce the amount of tissue lost.

b. Pain:

(1) Control of Pain. The control of pain accompanying disease or injury under survival situations is both difficult and essential. In addition to its morale-breaking discomfort, pain contributes to shock and makes the survivor more vulnerable to enemy influences. Ideally, pain should be eliminated by the removal of the cause. However, this is not always immediately possible, hence measures for the control of pain are beneficial.

(2) Position, Heat, and Cold. The part of the body that is hurting should be put at rest, or at least its activity restricted as much as possible. The position selected should be the one giving the most comfort, and be the easiest to maintain. Splints and bandages may be necessary to maintain the immobilization. Elevation of the injured part, with immobilization, is particularly beneficial in the throbbing type pain such as is typical of the "mashed" finger. Open wounds should be cleansed, foreign bodies removed, and a clean dressing applied to protect the wound from the air and chance contacts with environmental objects. Generally, the application of warmth reduces pain—toothache, bursitis, etc. However, in some conditions, application of cold has the same effect—strains and sprains. Warmth or cold is best applied by using water due to its high specific heat, and the survivor can try both to determine which is most beneficial.

(3) Pain Killers. Drugs are very effective in reducing pain; however, they are not likely to be available in the survival situation. Hence, the importance of the above "natural" procedures. Aspirin, APCs, and such tablets are primarily intended to combat the discomforts of colds and upper respiratory diseases, and, at best, will just take the edge off severe pain. They should be taken, however, if available. If no aspirin is available, there are some parts of vegetation which can be used. For example, most of the willows have been used for their pain-relieving and fever-lowering properties for hundreds of years. The fresh bark contains salicin, which probably decomposes into salicylic acid in the human body. Wintergreen, also known as checkerberry, was used by some Indians for body aches and pains. The leaves are made into a tea. The boiled bark of the magnolia tree helps relieve internal pains and fever, and has been known to stop dysentery. To be really effective in control of pain, stronger narcotic drugs such as codeine and morphine are required. During active hostilities, morphine may be available in aircraft and individual first aid kits.

c. Shock:

(1) Circulatory Reaction. Shock in some degree accompanies all injuries to the body, and frequently it is the most serious consequence of the injury. In essence, shock is a circulatory reaction of the body (as a whole) to an injury (mechanical or emotional). While the changes to the circulatory system initially favor body resistance to the injury (by ensuring adequate blood supply to vital structures), they may progress to the point of circulatory failure and death. All aircrew members should be familiar with the signs and symptoms of shock so that the condition may be anticipated, recognized, and dealt with effectively. However, the best survival approach is to treat ALL moderate and severe injuries for shock. No harm will be done, and such treatment will speed recovery.

(2) Fluids. Normally, fluids administered by mouth are generally prohibited in the treatment of shock following severe injury. Such fluids are poorly absorbed when given by mouth, and they may interfere with later administration of anesthesia for surgery. In survival medicine, however, the situation is different in that the treatment being given is the final treatment. Survivors cannot be deprived of water for long periods just because they have been injured; in fact, their recovery depends upon adequate hydration. Small amounts of warm water, warm tea, or warm coffee given frequently early in shock are beneficial if the patient is conscious, can swallow, and has no internal injuries. In later shock, fluids by mouth are less effective as they are not absorbed from the intestines. Burns, particularly, require large amounts of water to replace fluid lost from injured areas. Alcohol should never be given to a person in shock or who may go into shock.

(3) Psychogenic Shock. Psychogenic shock is frequently noted during the period immediately following an emergency; for example, bailout. Psychogenic shock, which occurs even without injury, requires attention to limit it, both in degree and duration. The degree of this post-impact shock varies widely among individuals but its occurrence is almost universal. In reality, the survivor has passed through two major emergencies almost simultaneously; the aircraft incident leading to the survival situation, and the situation itself. Should the survivor be injured (and the majority of them are), a third emergency is added. It is not uncommon, then, that some psychogenic reaction with circulatory implications occurs. Resistance to this type of shock depends upon the individual's personality and the amount of training previously received. Treatment consists of stopping all activities (when possible), relaxing, evaluating the situation, and formulating a plan of action before the survival situation begins.

d. Fractures:

(1) Proper immobilization of fractures, dislocations, and sprains is even more important in survival medicine than in conventional first aid. Rather than merely making the patient comfortable during transport to eventual treatment, in survival medicine, the initial immobilization is part of the ultimate treatment. Immobilizing body parts to help control pain was discussed earlier. In addition, immobilization in proper position hastens healing of fractures and improves the ultimate functional result. In the survival situation, the immobilization must suffice for a relatively long period of time and permit the patient to maintain a fairly high degree of mobility. Materials for splinting and bandaging are available in most survival situations, and proper techniques are detailed in most first aid manuals.

(2) The reduction of fractures is normally beyond the scope of first aid; however, in the prolonged survival situation, the correction of bone deformities is necessary to hasten healing and obtain the greatest functional result. The best time for manipulation of a fracture is in the period immediately following the injury, before painful muscle spasms ensue. Traction is applied until overriding fragments of bone are brought into line, (check by the other limb) and the extremity is firmly immobilized. Frequently, it is advantageous to continue traction after reduction to ensure the proper alignment of the bones.

(3) As plaster casts are not available in the survival situation, improvising an immobilization device is necessary. This may be done by using several parallel, pliable willow branches, woven together with vines or parachute lines. Use care so that the extremity is not constricted when swelling follows the injury. In an escape and evasion situation, it may be necessary to preserve the mobility of the survivor after reduction of the fracture. This is difficult in fractures of the lower extremities, although tree limbs may be improvised as

crutches. With companions, the use of improvised litters may be possible.

(4) Reduction of dislocated joints is done similar to that of fractures. Gentle, but firm, traction is applied and the extremity is manipulated until it "snaps" back into place. If the survivor is alone, the problem is complicated but not impossible. Traction can still be applied by using gravity. The distal portion of the extremity is tied to (or wedged) into the fork of a tree or similar point of fixation. The weight of the body is then allowed to exert the necessary traction, with the joint being manipulated until the dislocation is reduced.

e. Infection:

(1) Infection is a serious threat to the survivor. The inevitable delay in definite medical treatment and the reality of the survival situation increases the chances of wound infection. Antibiotics may not be available in sufficient amounts in the survival situation. In survival medicine, one must place more emphasis on the prevention and control of infection by applying techniques used before the advent of antibiotics.

(2) Unfortunately, survivors have little control over the amount and type of infection introduced at the time of injury. However, they can help control the infection by wearing clean clothes. Use care to prevent additional infection into wounds. Wounds, regardless of the type or severity, should not be touched with dirty hands or objects. One exception to this rule is the essential control of arterial bleeding. Clothing should be removed from wounds to avoid contamination surrounding skin areas.

(3) All wounds should be promptly cleansed. Water is the most universally available cleaning agent, and should be (preferably) sterile. At sea level, sterilize water, by placing it in a covered container and boiling it for 10 minutes. Above 3,000 feet, water should be boiled for 1 hour (in a covered container) to ensure adequate sterilization. The water will remain sterile and can be stored indefinitely as long as it is covered.

(a) Irrigate wounds rather than scrubbing to minimize additional damage to the tissue. Foreign material should be washed from the wound to remove sources of continued infection. The skin adjacent to wounds should be washed thoroughly before bandaging. When water is not available for cleaning wounds, the survivor should consider the use of urine. Urine may well be the most nearly sterile of all fluids available and, in some cultures, is preferred for cleaning wounds. Survivors should use urine from the midstream of the urine flow.

(b) While soap is not essential to clean wounds, a bar of medicated soap placed in a personal survival kit and used routinely would do much to prevent the infection of seemingly inconsequential injuries. External antiseptics are best used for cleaning abrasions, scratches, and the skin areas adjacent to lacerations. Used in deep, larger wounds, antiseptics produce further tissue damage.

(c) Nature also provides antiseptics which can be used for wound care. The American mountain ash is found from Newfoundland south to North Carolina and its inner bark has antiseptic properties. The red berries contain ascorbic acid and have been eaten to cure scurvy. The Sweet Gum bark is still officially recognized as being an antiseptic agent. Water from boiled Sweet Gum leaves can also be used as antiseptic for wounds.

f. The "Open Treatment" Method. This is the only safe way to manage survival wounds. No effort should be made to close open wounds by suturing or by other procedure. In fact, it may be necessary to open the wound even more to avoid entrapment or infection and to promote drainage. The term "open" does not mean that dressings should not be used. Good surgery requires that although wounds are not "closed," nerves, bone, and blood vessels should be covered with tissue. Such judgment may be beyond the capability of the aircrew member, but protection of vital structures will aid in the recovery and ultimate function. A notable exception to "open treatment" is the early closure of facial wounds which interfere with breathing, eating, or drinking. Wounds, left open, heal by formation of infection resistant granulation tissue (proud flesh). This tissue is easily recognized by its moist red granular appearance, a good sign in any wound.

g. Dressings and Bandages. After cleansing, all wounds should be covered with a clean dressing. The dressing should be sterile; however, in the survival situation, any clean cloth will help to protect the wound from further infection. A proper bandage will anchor the dressing to the wound and afford further protection. Bandages should be snug enough to prevent slippage, yet not constrictive. Slight pressure will reduce discomfort in most wounds and help stop bleeding. Once in place, dressings should not be changed too frequently unless required. External soiling does not reduce the effectiveness of a dressing, and pain and some tissue damage will accompany any removal. In addition, changing dressings increases the danger of infection.

h. Physiological "Logistics." Despite all precautions, some degree of infection is almost universal in survival wounds. This is the primary reason for the "open" treatment advocated above. The human body has a tremendous capacity for combating infections if it is permitted to do so. The importance of proper rest and nutrition to wound healing and control of infection has been mentioned. In addition, the "logistics" of the injured part should be improved. The injury should be immobilized in a position to favor adequate circulation, both to and from the wound. Avoid constrictive clothing or bandages. Applying heat to an infected wound further aids in mobilizing local body defense measures. Lukewarm saltwater soaks will help draw out infection and promote oozing of fluids from the wound, thereby removing toxic products. Poultices, made of clean clay, shred-

ded bark of most trees, ground grass seed, etc., do the same thing.

i. Drainage. Adequate natural drainage of infected areas promotes healing. Generally, wicks or drains are unnecessary. On occasion, however, it may be better to remove an accumulation of pus (abscess) and insert light, loose packing to ensure continuous drainage. The knife or other instrument used in making the incision for drainage must be sterilized to avoid introducing other types of organisms. The best way to sterilize in the field is with heat, dry or moist.

j. Antibiotics. Antibiotics, when available, should be taken for the control of infection. Consensus is that the drug should be of the so-called "broad spectrum type;" that is, be effective against any micro-organisms rather than specific for just one or two types. The exact amount to be included in survival kits will vary with the drug and basic assumptions as to the number and types of infections to be expected. Remember that antibiotics are potency-dated items (shelf-life about 4 years), and including them in survival kits requires kit inspection and drug replacement with active medical stocks.

k. Debridement. (The surgical removal of lacerated, devitalized, or contaminated tissue.) The debridement of severe wounds may be necessary to minimize infection (particularly of the gas gangrene type) and to reduce septic (toxic) shock. In essence, debridement is the removal of foreign material and dead or dying tissue. The procedure requires skill and should only be done by nonmedical personnel in case of dire emergency. If required, follow these general rules. Dead skin must be cut away. Muscle may be trimmed back to a point where bleeding starts and gross discoloration ceases. Fat which is damaged tends to die and should be cut away. Bone and nerves should be conserved where possible and protected from further damage. Provide ample natural drainage for the potentially infected wound and delay final closure of the wound.

l. Burns:

(1) Burns, frequently encountered in aircraft accidents and subsequent survival episodes, pose serious problems. Burns cause severe pain, increase the probability of shock and infection, and offer an avenue for the loss of considerable body fluids and salts. Direct initial treatment toward relieving pain and preventing infection. Covering the wound with a clean dressing of any type reduces the pain and chance for infection. Further, such protection enhances the mobility of the patient and the capability for performing other vital survival functions. In burns about the face and neck, ensure the victim has an open airway. If necessary, cricothyroidotemy should be done before the patient develops extreme difficulties. Burns of the face and hands are particularly serious in a survival situation as they interfere with the capability of survivors to meet their own needs. Soaking certain barks (willow, oak, maple) in water soothes and protects burns by astringent action. This is a function of the acid content of the bark used.

(2) Maintenance of body fluids and salts is essential to recover from burns. The only way to administer fluids in a survival situation is by mouth; hence the casualty should ingest sufficient water early before the nausea and vomiting of toxicity intervenes. Consuming the eyes and blood (both cooked) of animals can help restore electrolyte levels if salt tablets are not available. NOTE: The survivor may also pack salt in personal survival kits to replace electrolytes (¼ teaspoon per quart of water).

m. Lacerations: Lacerations (cuts) are best left open due to the probability of infection. Clean thoroughly, remove foreign material, and apply a protective dressing. Frequently, immobilization will hasten the healing of major lacerations. On occasion (tactical), it may be necessary to close (cover) the wound, despite the danger of infection, in order to control bleeding or increase the mobility of the patient. If a needle is available, thread may be procured from parachute lines, fabric, or clothing, and the wound closed by "suturing." If suturing is required, place the stitches individually, and far enough apart to permit drainage of underlying parts. Do not worry about the cosmetic effect; just approximate the tissue. For scalp wounds, hair may be used to close after the wound is cleansed. Infection is less a danger in this area due to the rich blood supply.

n. Head Injuries. Injuries to the head pose additional problems related to brain damage as well as interfering with breathing and eating. Bleeding is more profuse in the face and head area, but infections have more difficulty in taking hold. This makes it somewhat safer to close such wounds earlier to maintain function. Cricothyroidotemy may be necessary if breathing becomes difficult due to obstruction of the upper airways. In the event of unconsciousness, watch the patient closely and keep him or her still. Even in the face of mild or impending shock, keep the head level or even slightly elevated if there is reason to expect brain damage. Do not give fluids or morphine to unconscious persons.

o. Abdominal Wounds. Wounds of the abdomen are particularly serious in the survival situation. Such wounds, without immediate and adequate surgery, have an extremely high mortality rate and render patients totally unable to care for themselves. If intestines are not extruded through the wound, a secure bandage should be applied to keep this from occurring. If intestine is extruded, do not replace it due to the almost certain threat of fatal peritonitis. Cover the extruded bowel with a large dressing and keep the dressing wet with any fluid that is fit to drink, or urine. The patient should lie on the back and avoid any motions that increase intra-abdominal pressure which might extrude more bowel. Keep the survivor in an immobile state or move on a litter. "Nature" will eventually take care of

the problem; either through death, or walling-off of the damaged area.

p. Chest Injuries. Injuries of the chest are common, painful and disabling. Severe bruises of the chest or fractures of the ribs require that the chest be immobilized to prevent large painful movements of the chest wall. The bandage is applied while the patient deeply exhales. In the survival situation, it may be necessary for survivors to wrap their own chest. This is more difficult but can be done by attaching one end of the long bandage (parachute material) to a tree or other fixed object, holding the other end in the hand, and slowly rolling body toward the tree, keeping enough counterpressure on the bandage to ensure a tight fit.

q. Sucking Chest Wounds. These wounds are easily recognized by the sucking noise and appearance of foam or bubbles in the wound. These wounds must be closed immediately before serious respiratory and circulatory complications occur. Ideally, the patient should attempt to exhale while holding the mouth and nose closed (Valsalva) as the wound is closed. This inflates the lungs and reduces the air trapped in the pleural cavity. Frequently, a taped, airtight dressing is all that is needed, but sometimes it is necessary to put in a stitch or two to make sure the wound is closed.

r. Eye Injuries. Eye injuries are quite serious in a survival situation due to pain and interference with other survival functions. The techniques for removing foreign bodies and for treating snow blindness are covered in standard first aid manuals. More serious eye injuries involving disruption of the contents of the orbit may require that the lids of the affected eye be taped closed or covered to prevent infection.

s. Thorns and Splinters. Thorns and splinters are frequently encountered in survival situations. Reduce their danger by wearing gloves and proper footgear. Their prompt removal is quite important to prevent infection. Wounds made by these agents are quite deep compared to their width which increases chances of infection by those organisms (such as tetanus) which grow best in the absence of oxygen. Removal of splinters is aided by the availability of a sharp instrument (needle or knife), needle nose pliers, or tweezers. Take care to get all of the foreign body out; sometimes it is best to open the wound sufficiently to properly cleanse it and to allow air to enter the wound. When cleaned, treat as any other wound.

t. Blisters and Abrasions. Care for blisters and abrasions promptly. Foot care is extremely important in the survival situation. If redness or pain is noted, the survivor should stop (if at all possible) to find and correct the cause. Frequently, a protective dressing or bandage and(or) adhesive will be sufficient to prevent a blister. If a blister occurs, do not remove the top. Apply a sterile (or clean) dressing. Small abrasions should receive attention to prevent infection. Using soap with a mild antiseptic will minimize the infection of small abrasions which may not come to the attention of the survivor.

u. Insect Bites. Bites of insects, leeches, ticks, chiggers, etc., pose several hazards. Many of these organisms transmit diseases, and the bite itself is likely to become infected, especially if it itches and the survivor scratches it. The body should be inspected frequently for ticks, leeches, etc., and these should be removed immediately. If appropriate and possible, the survivor should avoid infested areas. These parasites can best be removed by applying heat or other irritant to them to encourage a relaxation of their hold on the host. Then the entire organism may be gently detached from the skin, without leaving parts of the head imbedded. Treat such wounds as any other wound. Applying cold wet dressings will reduce itching, scratching, and swelling.

7-10. Illnesses. Many illnesses which are minor in a normal medical environment become major in a survival situation when the individual is alone without medications or medical care. Survivors should use standard methods (treat symptoms) to prevent expected diseases since treatment in a survival situation is so difficult. Key preventive methods are to maintain a current immunization record, maintain a proper diet, and exercise.

a. Food Poisoning. Food poisoning is a significant threat to survivors. Due to sporadic food availability, excess foods must be preserved and saved for future consumption. Methods for food preservation vary with the global area and situation. Bacterial contamination of food sources has historically caused much more difficulty in survival situations than the ingestion of so-called poisonous plants and animals. Similarly, dysentery or water-borne diseases can be controlled by proper sanitation and personal hygiene.

b. Treatment of Food Poisoning. If the food poisoning is due to preformed toxin; staphylococcus, botulism, etc. (acute symptoms of nausea, vomiting, and diarrhea soon after ingestion of the contaminated food), supportive treatment is best. Keep the patient quiet and lying down, and ensure the patient drinks substantial quantities of water. If the poisoning is due to ingestion of bacteria which grow within the body (delayed gradual onset of same symptoms), take antibiotics (if available). In both cases, symptoms may be alleviated by frequently eating small amounts of fine, clean charcoal. In PW situations, if chalk is available, reduce it to powder, and eat to coat and soothe the intestines. Proper sanitation and personal hygiene will help prevent spreading infection to others in the party or continuing reinfection of the patient.

Chapter 8

PW MEDICINE

8-1. Introduction:

a. Imprisoned PWs are, in the physical sense at least, under the control of their captors. Thus, the application of survival medicine principles will depend on the amount of medical service and supplies the captors can, and will, give to their prisoners. An enemy may both withhold supplies and confiscate survivor's supplies. Some potential enemies (even if they wanted to provide PW medical support) have such low standards of medical practice that their best efforts could jeopardize the recovery of the patient (figure 8-1).

b. An interesting and important sociological problem arises in getting medical care for PWs. How far should prisoners go in their efforts to get adequate rations and medicines for themselves or those for whom they are responsible? The Code of Conduct is quite specific concerning consorting with the enemy. Individuals must use considerable judgment in deciding whether to forget the welfare of fellow prisoners in order to follow the letter of the Code. Even more questionable is the individual who will offer such a justification for personal actions. Again, these questions involve more than purely medical consideration. In combat, there are apt to be frequent situations in which medical considerations are outweighed by more important ones.

8-2. History:

a. As in past wars, there were professional medical personnel among the captives in North Vietnam; however, these personnel were not allowed to care for the sick and injured as in the past. Medical care and assistance from the captors were limited and generally below comparable standards of the United States. Yet 566 men returned, most in good physical and psychological condition, having relied to a large extent on their own ingenuity, knowledge, and common sense in treating wounds and diseases. They were able to recall childhood first aid, to learn by trial and error, and to use available resources. Despite their measures of success in this respect, many released personnel felt that with some prior training, considerable improvement in self-help techniques was possible even in the most primitive conditions.

Figure 8-1. PW Medicine.

b. To determine how the services could help and to assist future PWs to care for themselves if the situation required it, the Medical Section of the Air Force Intelligence Service, with the Surgeon General of the Air Force, sponsored a 5-day seminar to examine the pertinent medical experiences of captivity and to recommend appropriate additions and changes in training techniques. As a basis for seminar discussion, Air Training Command provided data on the major diseases, wounds, and ailments, and the treatment methods used by the captives in Southeast Asia. Transcripts (325) of debriefing material were screened for medical data. Significant disease categories were established for analysis simplification based on the freqency of the problems encountered.

PROBLEMS	MAJOR CATEGORIES ESTABLISHED
Dysentery	Trauma (lacerations, burns, fractures)
Fungus	Gastrointestinal problems
Dental problems	Communicable diseases
Intestinal problems	Nutritional diseases
Fractures	Dermatological ailments
Lacerations	Dental problems
Respiratory ailments	
Burns	

In examining these major categories, attention was focused on those medical problems considered significant by the prisoners themselves in evaluating their primitive practices (self-help).

8-3. Trauma:

a. Most of the prisoners began their captivity experience with precapture injuries—burns, wounds, fractures, and lacerations. Other injuries were the result of physical abuse while a prisoner. Most of these individuals, upon their return, expressed a need to know more about managing their injuries in captivity and also what to expect about the long-term effects of injuries. It was not evident to them that the practice of a few simple rules will generally lead to acceptable results in wound treatment, and that much can be done after repatriation to correct cosmetic and functional defects.

b. The groundwork for management of injuries should begin well before an individual enters the captivity or survival environment. The treatment of injuries in survival or captivity depends primarily on providing the body the best possible circumstances to "repair itself." It is vital, therefore, to have the body in the best possible physical condition before exposure to survival or captivity. This means good cardiovascular conditioning, good muscle strength and tone, and good nutritional status. Physiological and nutritional status will markedly influence the rate and degree of healing in response to injury. The opportunity for maintaining the best possible physical conditioning and nutritional status in captivity will be greatly reduced. (Once in a captivity or survival setting, it is important to do everything possible to maintain a good physiological and nutritional status.)

8-4. Gastrointestinal Problems:

a. Diarrhea. This was a common ailment in the prison environment, not only in Vietnam, but also in WW II and Korea. It plagued the forces of North Vietnam and the allied forces. This was the second most frequent malady afflicting the Viet Cong forces. The causative factors of this almost epidemic state were varied. A variety of infectious agents gaining access to the body by use of contaminated food and water certainly contributed to the problem. Equally important as causative agents were the low level of sanitation and hygiene practices within the camps. Psychogenic responses to unappetizing diet, nutritional disturbances, and viral manifestations also contributed.

(1) Captor Therapy. This consisted primarily of local or imported antidiarrheal agents, antibiotics, and vitamins. Appropriate diet therapy was instituted.

(2) Captive Self-Therapy. After instituting diet restrictions (solid food denial and increased liquid intake), afflicted personnel were administered "concoctions" of banana skins, charcoal, chalk, or tree bark tea.

(3) Treatment Evaluation. The accepted therapy for diarrhea focuses on the causative factors which in the captivity experience were largely neglected. From a symptomatic perspective, the principles of self-treatment are simple to master: restrict intake to nonirritating foods (avoid vegetables and fruits), establish hygienic standards, increase fluid intake, and, when available, use antidiarrheal agents. The prisoners often resorted to a more exotic therapeutic regimen consisting of banana skins, charcoal, chalk, salt restriction, rice, or coffee. Charcoal, chalk, and the juice of tree barks have a scientific basis for their therapeutic success. Inasmuch as diarrhea was a source of concern and a disability for the North Vietnamese as well as the captives, therapy was often offered on request and was appropriate and successful.

(4) Conclusion. Diarrhea was frequent among PWs during captivity. Seldom fatal, it was disabling and a source of concern to those afflicted. Most captives were treated on demand and improved. This condition lends itself to some form of self-therapy through an understanding of its physiological derangements. The PW re-

sponded with intelligence, common sense, and a reasonably effective self-help regimen.

b. Dysentery. From a symptomatic perspective, dysentery is a severe form of diarrhea with passage of mucous and blood. Treatment and conclusions are similar to those for diarrhea.

c. Worms and Intestinal Parasites. Worms were extremely common among the captives. Twenty-eight percent of the released prisoners indicated worms as a significant medical problem during captivity. Worms often caused gastrointestinal problems similar to those resulting from a variety of other causes. The pin worm appears to have been the primary cause. This is not surprising, as its distribution is worldwide and the most common cause of helminthic infection of people in the United States. It requires no intermediate host; hence, infection is more rapidly acquired under poor hygienic conditions so commonly found in warm climates and conditions similar to the captivity environment. Seldom fatal, worms are significant, as they can lower the general resistance of the patient and may have an adverse affect on any intercurrent illness.

(1) Captor Therapy. This consisted of antihelminthic agents (worm medicine) dispensed without regularity, but with satisfactory results.

(2) Captive Therapy. The nuisance and irritating aspects of worms led to severe rectal itching, insomnia, and restlessness. This motivated the prisoner to find some form of successful self-therapy. Prevention was a simple and readily obtainable goal. Shoes were worn when possible; hands were washed after defecation; and fingernails were trimmed close and frequently. Peppers, popular throughout the centuries in medicine, contain certain substances chemically similar to morphine. They are effective as a counter-irritant for decreasing bowel activity. Other "house remedies" popular among the captives included drinking saltwater (a glass of water with 4 tablespoons of salt added), eating tobacco from cigarettes (chewing up to two or three cigarettes and swallowing them), and infrequently drinking various amounts of kerosene. All of these remedies have some degree of therapeutic effectiveness, but are not without danger and therefore deserve further comment. Saltwater alters the environment in the gastrointestinal tract and can cause diarrhea and vomiting. Too large an amount can have harmful effects on body fluid mechanisms and can lead to respiratory complications and death. Tobacco contains nicotine and historically was popular in the 19th century as an emetic expectorant and was used for the treatment of intestinal parasites. Nicotine is, however, one of the most toxic of all drugs and can cause death when more than 60 mg is ingested. A single cigarette contains about 30 mg of nicotine, so the captives who ate two or more cigarettes had been using a cure more dangerous than the disease. Kerosene is also toxic with 3 to 4 ounces capable of causing death. It is particularly destructive to the lungs and if through vomiting it were to make its way into the trachea and eventually the lungs, the complications would then again be far worse than the presence of worms.

(3) Treatment Evaluation. The antihelminthics therapy used by the captors was extremely effective. The problem during confinement was the nonavailability of such medication on demand. In addition, the inability to practice proper hygienic standards assured the continuation of, and reinfection with, worms.

(4) Conclusion. Worm infection in confinement is common and expected. It is seldom fatal, but contributes to general disability and mental depression due to its nuisance symptoms. Under certain circumstances, worms can assist in the spread of other diseases. The principle to follow in self-care is simple—use as high a hygienic standard as possible, and use medication causing bowel paristalsis and worm expulsion. Substances which interfere with the environment of the worms will aid in their expulsion. The toxic "house remedies" must be weighed against their possible complications.

8-5. Hepatitis. Infection of the liver was fairly common in some camps and present among the prison population throughout the captivity experience. Diagnosis was usually made on the basis of change of skin color to yellow (jaundice).

a. Captor Treatment. The Vietnamese seemed to have followed the standard therapy of rest, dietary management, and vitamin supplementation. They also displayed a heightened fear of the disease and avoided direct contact, when possible, with those afflicted.

b. Captive Therapy. For the most part, it parallels the therapy of the captors. This disease allows for little ingenuity or inventiveness of therapy.

c. Comments. Hepatitis is worldwide. Presumably most cases of hepatitis in captivity were viral in origin and easily disseminated to fellow prisoners. Conditions of poor sanitation and hygiene with close communal living foster its spread. Prevention through proper hygienic practices is the most effective tool. Equally important is an understanding of the disease characteristics. The majority of the cases recovered completely and less than 1 percent succumbed to this disease.

8-6. Nutritional Deficiencies. Symptoms attributed to malnutrition were frequent in the early years of confinement and continued up through 1969. The use of polished rice and the lack of fresh fruits and vegetables contributed to vitamin and protein deficiencies. From 1969 through 1973, food supplements were provided, and by release time, few obvious manifestations of diseases were present among those returning. The primary problems during the early years were vitamin deficiencies.

a. Vitamin B Deficiency (Beri-Beri). Presumably present among several PWs (especially those confined to the Briarpatch (Xom Ap Lo) about 15 miles west of

Sontay), it was rarely diagnosed on return. Its primary manifestation was pain in the feet described by the captives as "like a minor frostbite that turned to shooting pains."

(1) Captor Therapy. Prisoners were treated with vitamin injections and increased caloric content.

(2) Captive Therapy. Increasing caloric intake by eating anything of value. No specific self-care program existed for this malady.

(3) Comments. Beri-beri is a nutritional disease resulting from a deficiency of vitamin B (Thiamine). It is widespread in the Orient and in tropical areas where polished rice is a basic dietary staple. Of the various forms of the disease, dry beri-beri would seem most important to the confinement condition. Early signs and symptoms of the disease include muscle weakness and atrophy, loss of vibratory sensation over parts of the extremities, numbness, and tingling in the feet. From the comments of the PWs, it is difficult to formulate a diagnosis. Modern therapy consists of vitamin B or sources of the vitamin in food (such as green peas, cereal grains, and unpolished rice).

(4) Conclusion. In Vietnam, the possible early onset of the dry form of beri-beri was encountered. This is supported by the symptoms described and by the existence of dietary shortages of vitamin B and other nutritional deficiency.

b. Vitamin A Deficiency. There were several reported cases of decreased vision (primarily at night) attributed to vitamin A deficiency. This problem usually occurred during periods of punishment or politically provoked action when food was withheld as part of the discipline. The condition responded well to increased caloric intake and deserves little special mention. An understanding of the transient nature of this problem and its remedial response to therapy is important.

8-7. Communicable Diseases. Some communicable diseases were endemic in North Vietnam and certainly responsible for large scale disability among the personnel of the enemy forces. Plague, cholera, and malaria are frequent and a serious public health menace. Thanks to the immunization practices of the American forces, these diseases were of little concern to Americans during their captivity.

8-8. Skin Diseases:

a. Lesions. Dermatological lesions were common to the various prison experiences. Their importance lies not in their lethality (as they apparently did not cause any deaths), but for their irritant quality and the debilitating and grating effect on morale and mental health. Boils, fungi, heat rash, and insect bites appeared frequently and remained a problem throughout the captivity experience.

b. Boils and Blisters. A deep-seated infection usually involves the hair follicles and adjacent subcutaneous tissue, especially parts exposed to constant irritation.

(1) Captor Treatment. Prisoner complaints about the presence of boils usually brought about some action by the captors. Treatment varied considerably and obviously depended on the knowledge of medics, doctors treating their prisoners, the availability of medical supplies, and the current camp policy. For the most part, systemic antibiotics, sulfa, and tetracycline were administered. In other instances, the boils were lanced or excised and treated with topical astringents.

(2) Captive Treatment. As the medics normally responded to pleas about boils, self-treatment was practiced primarily when there was distrust of captor techniques. Prisoners would attempt to lance the boil with any sharp instrument such as needle, wire, splinters, etc., and exude their contents by applying pressure. The area was then covered with toothpaste and, when available, iodine.

(3) Comments. As noted above, the boil is an infection of hair follicles. It is more frequent in warm weather and aggravated by sweat which provides ideal conditions for the bacteria. Boils seldom appear singularly. Once present, they are disseminated by fingers, clothing, and discharges from the nose, throat, and groin. Modern therapy consists of hot compresses to hasten localization, and then conservative incision and drainage. Topical antibiotics and systemic antibiotics are then used. Boils increase in frequency with a decrease in resistance as seen in malnutrition and exhaustion states in a tropical environment. This almost mimics the prison conditions.

(4) Conclusions. Self-help treatment is limited. Of importance here is sterility when handling the boils, cleanliness, exposure to sunlight, keeping the skin dry, and getting adequate nutrition. The disease is self-limiting and not fatal. The application of any material or medication with a detergent effect may be used (soaks in saline, soap, iodine, and topical antibiotics).

8-9. Fungal Infections. Fungal infections were also a common skin problem for those in Southeast Asia captivity. As with other skin lesions, they are significant for their noxious characteristics and weakening effect on morale and mental health. Superficial fungal infections of the skin are widespread throughout the world. Their frequency among PWs reflects the favorable circumstances of captivity for cultivating fungal infections.

a. Captor Therapy. Treatment consisted of medication described by many PWs as iodine and the occasional use of sulfa powder.

b. Captive Therapy. Treatment (often the result of memory of childhood experiences and trial and error observations) consisted of the removal of body hair (to prevent or improve symptoms in the case of heat rash), exposure to sunlight to dry out fungal lesions, and de-

velopment of effective techniques to foster body cooling and to decrease heat generation. Considerable effort was directed at keeping the body clean.

c. Comments. Superficial Dermatoses (skin lesions) due to fungi were common. Their invasive powers are at best uniformly weak, and because of this, infections are limited to the superficial portions of the skin and seldom by themselves fatal. Modern therapy since 1958 has relied heavily on an oral antifungal agent effective against many superficial fungi. This drug is expensive and not available in many parts of the world. Several lotions and emulsions can be used with some success. Elemental iodine is widely used as a germicide and fungicide. It is an effective antiseptic and obviously found favor in North Vietnam because of its availability. Without professional therapy, self-help, although limited in scope, can be effective. The principle of wet soaks for dry lesions and dry soaks for wet lesions is a fairly reliable guide. The use of the Sun as a drying agent can also be very effective.

d. Conclusions. Skin problems are common to the captivity environment. More importantly, extreme personal discomfort, accompanied by infection, was detrimental to the physical and mental well-being of the prisoner.

8-10. Dental Problems. These were common among all captives, not only during confinement, but also before capture. They were secondary to facial injury during egress, or caused by physical abuse during interrogation. Periodontitis (inflammation of tissue surrounding the tooth), pyorrhea (discharge of pus), and damage to teeth consistent with poor hygiene and "wear and tear" were also present.

a. Specific Complaints. Pain associated with the common toothache represented one of the most distressing problems faced by the PW. It affected the PW's nutrition and robbed the PW of the physical pleasure of eating (a highlight of isolated captivity). The inability of the PW to adequately deal with this problem caused persistent anxiety and decreased the ability to practice successful resistance techniques. In a few isolated instances, PWs actually considered collaboration with the captors in exchange for treatment and relief from tooth pain.

b. Captor Treatment. Treatment varied considerably and was no doubt influenced by political considerations. "Dentists" were infrequently available in camps before 1969. Cavities were filled, although usually inadequately, with subsequent loss of the filling. Use of local anesthesia also varied depending on the dentist providing care.

c. Captive Therapy. The PWs often chose to treat themselves rather than seek or accept prison dentistry when it was available. Abscesses were lanced with sharp instruments made locally out of wood, bamboo, or whatever was available. Brushing was excessive, again using whatever was available; chew sticks common to Asia were widely used. Aspirin (ASA), when available, was applied directly to the tooth or cavity.

d. Commentary. The self-help practices noted above had many positive aspects. The basic principle of maintaining a well-planned cleaning program using fiber, brushes, or branches certainly contributed to the relatively low incidence of cavities and infection among the prisoners. The lancing of abscesses using bamboo sticks, although not a professional maneuver, has merit insofar as the pressure is relieved and the tendency to develop into cellulitis (widespread infection) decreased. The application of aspirin directly into the cavity should be discouraged as might the application of any other substance not directly produced for this purpose.

e. Conclusions. The most effective tool against dental complications in captivity is proper preventive dentistry. The present program of the three services, if adhered to, is adequate to ensure a high state of dental hygiene while captive.

8-11. Burns. Burns were an extremely frequent injury among PWs. Severity ranged from first through third degree and occurred frequently on hands and arms.

a. Captor Treatment. For the most part, burns were treated by captors by cleaning the burns and applying antiseptics and bandages. The results obtained were, by and large, inadequate, with frequent infections and long-term debilitation.

b. Captive Treatment. No specific treatment was developed among the PWs for burns. Reliance for some form of therapy was almost completely left to the captor.

c. Commentary. Burns are extremely painful and can severely interfere with the ability to escape or to survive in captivity. The basic principle here is prevention.

d. Prevention. Adequate protection of exposed surfaces while flying (flame-retardant suits, gloves, boots, and helmet with visor down) is the best preventive action.

8-12. Lacerations and Infections:

a. Treatment. Captor treatment for lacerations and infections reflected the medical standards in North Vietnam and their domestic priorities. Wound and infection treatment varied considerably from being adequate to substandard and malpracticed. Obviously, the availability of trained physicians, a changing political climate, and difficulty in obtaining sophisticated medical supplies and equipment dictated and influenced the quality of the care delivered. The prisoners could do little professionally with this type of injury. As with diseases, the maintenance of good nutritional standards, cleanliness, and "buddy self-care" were the basic treatments.

b. Comments. When soft tissue is split, torn, or cut, there are three primary concerns—bleeding, infection, and healing of the wound.

(1) Bleeding is the first concern and must be controlled as soon as possible. Most bleeding can be controlled by direct pressure on the wound and that should be the first treatment used. If that fails, the next line of defense would be the use of classic pressure points to stop hemorrhaging. And the last method for controlling hemorrhage would be the tourniquet. The tourniquet should be used only as a last resort. Even in more favorable circumstances where the tourniquet can be applied as a first aid measure and left in place until trained medical personnel remove it, the tourniquet may result in the loss of the limb. The tourniquet should be used only when all other measures have failed, and it is a life and death matter. To control bleeding by direct pressure on the wound, sufficient pressure must be exerted to stop the bleeding, and that pressure must be maintained long enough to "seal off" the bleeding surfaces. Alternate pressing and then releasing to see if the wound is still bleeding is not desirable. It is best to apply the pressure and keep it in place for up to 20 minutes. Oozing blood from a wound of an extremity can be slowed or stopped by elevating the wound above the level of the heart.

(2) The next concern is infection. In survival or captivity, consider all breaks in the skin due to mechanical trauma contaminated, and treat appropriately. Even superficial scratches should be cleaned with soap and water and treated with antiseptics, if available. Antiseptics should generally not be used in wounds which go beneath the skin's surface since they may produce tissue damage which will delay healing. Open wounds must be thoroughly cleansed with boiled water. Bits of debris such as clothing, plant materials, etc., should be rinsed out of wounds by pouring large amounts of water into the wounds and ensuring that even the deepest parts are clean. In a fresh wound where bleeding has been a problem, care must be taken not to irrigate so vigorously that clots are washed away and the bleeding resumes. Allow a period of an hour or so after the bleeding has been stopped before beginning irrigation with the boiled water. Begin gently at first, removing unhealthy tissue, increasing the vigor of the irrigation over a period of time. If the wound must be cleaned, use great care to avoid doing additional damage to the wound. The wound should be left open to promote cleansing and drainage of infection. In captivity, frequently deep open wounds will become infested with maggots. The natural tendency is to remove these maggots, but actually, they do a good job of cleansing a wound by removing dead tissue. Maggots may, however, damage healthy tissue when the dead tissue is removed. So the maggots should be removed if they start to affect healthy tissue. Remember that it is imperative that the wound be left open and allowed to drain.

(3) An open wound will heal by a process known as secondary intention or granulation. During the healing phase, the wound should be kept as clean and dry as possible. For protection, the wound may be covered with clean dressings to absorb the drainage and to prevent additional trauma to the wound. These dressings may be loosely held in place with bandages (clean parachute material may be used for dressings and bandages). The bandages should not be tight enough to close the wound or to impair circulation. At the time of dressing change, boiled water may be used to gently rinse the wound. The wound may then be air dried and a clean dressing applied. (The old dressing may be boiled, dried, and reused.) Nutritional status is interrelated with the healing process, and it is important to consume all foods available to provide the best possible opportunity for healing.

c. Conclusions. Obviously the PW is at a distinct disadvantage in treating wounds, lacerations, and infections without modern medicine. Yet, knowledge of the basic principles mentioned above, locally available equipment and resources, and optimism and common sense can help a survivor to maintain life.

8-13. Fractures and Sprains. Fractures and sprains often occurred during shootdown and(or) egress from the aircraft. They also occurred during evasion attempts.

a. Captor Treatment. As with other treatment, treatment of sprains and fractures varied considerably depending on the severity of the injury and the resources available for treatment. Even after immediate treatment or surgical procedures, there was little followup therapy. Prisoners were usually returned to camp to care for themselves or to rely on the help of fellow prisoners.

b. Captive Treatment. Captive therapy was primarily that of helping each other to exercise or immobilize the injured area, and in severe cases, to provide nursing care.

c. Comments:

(1) An acute nonpenetrating injury to a muscle or joint can best be managed by applying cold as soon as possible after the injury. Icepacks or cold compresses should be used intermittently for up to 48 hours following the injury. This will minimize hemorrhage and disability. Be careful not to use snow or ice to the point where frostbite or cold injury occurs. As the injured part begins to become numb, the ice should be removed to permit rewarming of the tissues. Then the ice can be reapplied. Following a period of 48 to 72 hours, the cold treatment can be replaced by warm packs to the affected part. A "sprain or strain" may involve a wide variety of damage ranging from a simple bruise to deep hemorrhage or actual tearing of muscle fibers, ligaments, or tendons. While it is difficult to establish specific guidelines for treatment in the absence of a specific diagnosis, in general, injuries of this type require some period of rest (immobilization) to allow healing. The period of rest is followed by a period of rehabilitation (massage and exercise) to restore function. For what appears to be a simple superficial muscle problem, a period of 5 to 10

days rest followed by a gradual progressive increase in exercise is desirable. Pain should be a limiting factor. If exercise produces significant pain, the exercise program should be reduced or discontinued. In captivity, it is probably safest to treat severe injuries to a major joint like a fracture with immobilization (splint, cast) for a period of 4 to 6 weeks before beginning movement of the joint.

(2) Bone fractures are of two general types, open and closed. The open fracture is associated with a break in the skin over the fracture site which may range all the way from a broken bone protruding through the skin to a simple puncture from a bone splinter. The general goals of fracture management are: restore the fracture to a functional alignment; immobilize the fracture to permit healing of the bone; and rehabilitation. Restoring or reducing the fracture simply means realigning the pieces of bones, putting the broken ends together as close to the original position as possible. The natural ability of the body to heal a broken bone is remarkable and it is not necessary that an extremity fracture be completely straight for satisfactory healing to occur. In general, however, it is better if the broken bone ends are approximated so that they do not override. Fractures are almost always associated with muscle spasms which become stronger with time. The force of these muscle spasms tends to cause the ends of the broken bones to override one another, so the fracture should be reduced as soon as possible. To overcome the muscle spasm, force must be exerted to reestablish the length of the extremity. Once the ends of the bone are realigned, the force of the muscle spasm tends to hold the bones together. At this point, closed fractures are ready to be immobilized, but open fractures require treatment of the soft tissue injury in the manner outlined earlier. In other words, the wound must be cleansed and dressed, then the extremity should be immobilized. The immobilization preserves the alignment of the fracture and prevents movement of the fractured parts which would delay healing. For fractures of long bones of the body, it becomes important to immobilize the joints above and below the fracture site to prevent movement of the bone ends. In a fracture of the mid forearm, for example, both the wrist and the elbow should be immobilized. In immobilizing a joint, it should be fixed in a "neutral" or functional position. That is, neither completely straight nor completely flexed or bent, but in a position about midway between. In splinting a finger, for example, the finger should be curved to about the same position the finger would naturally assume at rest.

(3) A splint of any rigid material such as boards, branches, bamboo, metal boot insoles, or even tightly rolled newspaper may be almost as effective as plaster or mud casts. In conditions such as continuous exposure to wetness, the splint can be cared for more effectively than the plaster or mud cast. In cases where there is a soft tissue wound in close proximity to the fracture, the splint method of immobilization is more desirable than a closed cast because it permits change of dressing, cleaning, and monitoring of the soft tissue injury. The fracture site should be loosely wrapped with parachute cloth or soft plant fibers; then the splints can be tied in place extending at least the entire length of the broken bone and preferably fashioned in such a way as to immobilize the joint above and below the fracture site. The splints should not be fastened so tightly to the extremity that circulation is impaired. Since swelling is likely to occur, the bindings of the splint will have to be loosened periodically to prevent the shutting off of the blood supply.

(4) The time required for immobilization to ensure complete healing is very difficult to estimate. In captivity, it must be assumed that healing time will, in general, be prolonged. This means that for a fracture of the upper extremity of a "nonweight-bearing bone," immobilization might have to be maintained for 8 weeks or more to ensure complete healing. For a fracture of the lower extremity or a "weight-bearing bone," it might require 10 or more weeks of immobilization.

(5) Following the period of immobilization and fracture healing, a program of rehabilitation is required to restore normal functioning. Muscle tone must be reestablished and the range of motion of immobilized joints must be restored. In cases where joints have been immobilized, the rehabilitation program should be started with "passive range of motion exercises." This means moving the joint through a range of motion without using the muscles which are normally used to move that joint. For example, if the left wrist has been immobilized, a person would begin the rehabilitation program by using the right hand to passively move the left wrist through a range of motion which can be tolerated without pain. When some freedom of motion of the joint has been achieved, the individual should begin actively increasing that range of motion using the muscles of the joint involved. Do not be overly forceful in the exercise program—use pain as a guideline—the exercise should not produce more than minimal discomfort. Over a period of time, the joint movement should get progressively greater until the full range of motion is restored. Also, exercises should be started to restore the tone and strength of muscles which have been immobilized. Again, pain should be the limiting point of the program and progression should not be so rapid as to produce more than a minimal amount of discomfort.

8-14. Summary. Common sense and basic understanding of the type of injuries are most helpful in avoiding complication and debilitation. Adequate nourishment and maintenance of physical condition will materially assist healing of burns, fractures, lacerations, and other injuries—the body will repair itself.

8-15. Conclusions. In the management of trauma and burns in captivity or survival, remember that the body will do the healing or repair, and the purpose of the "treater" is to provide the body with the best possible atmosphere to conduct that self-repair. Some general principles are:

a. Be in the best possible physical, emotional, and nutritional status before being exposed to the potential survival or captivity setting.

b. Minimize the risk of injury at the time of survival or captivity by following appropriate safety procedures and properly using protective equipment.

c. Maintain the best possible nutritional status while in captivity or the survival setting.

d. Don't overtreat!!! Overly vigorous treatment can do more harm than good.

e. Use cold applications for relief of pain and to minimize disability from burns and soft tissue strains or sprains.

f. Clean all wounds by gentle irrigation with large amounts of the cleanest water available.

g. Leave wounds open.

h. Splint fractures in a functional position.

i. After the bone has healed, begin an exercise program to restore function.

j. Remember that even improperly healed wounds or fractures may be improved by cosmetic or rehabilitative surgery and treatment upon rescue or repatriation.

Part Four

FACTS AND CONDITIONS AFFECTING A SURVIVOR

Chapter 9

WEATHER

9-1. Introduction. History records many attempts by people of ancient cultures to understand the heavens. In the primitive past, the ability to predict weather was of primary importance. It was by observing the stars and other celestial bodies that these early societies could predict the coming of the seasons and therefore the weather patterns that played such a large role in their survivability. When people today are forced to live under the primitive conditions of a survival situation, they are no different from those who have struggled before them against those same conditions.

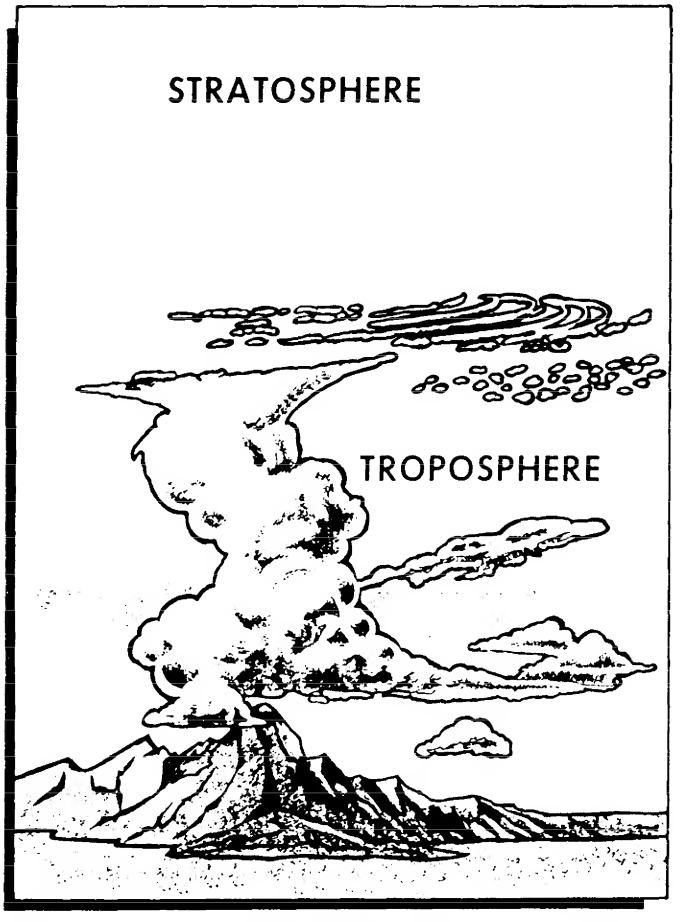


Figure 9-1. Structure of the Atmosphere.

9-2. Knowledge of Weather. However, today's participants in the age old struggle against nature must (out of necessity) still be concerned with the effect of weather. It is still true that weather cannot be controlled, but the person who is prepared (through knowledge) will be more successful.

a. Weather is not the same as climate. Weather is the state of the atmosphere, with respect to wind, temperature, cloudiness, moisture, pressure, humidity, etc. Climate, on the other hand, is the type of weather condition generally prevailing over a region throughout the year, averaged over a series of years.

b. The atmosphere extends upward from the surface of the Earth for a great many miles, gradually thinning as it approaches its upper limit. Near the Earth's surface, the air is relatively warm due to contact with the Earth. As altitude increases, the temperature decreases by about 3.5°F for every 1,000 feet until air temperature reaches about 67°F below zero at 7 miles above the Earth.

c. To understand where the weather patterns originate, a brief familiarization of the "layers" or structure of the atmosphere is needed (figure 9-1). The atmosphere is divided into two layers. The upper layer is the "stratosphere" where the temperature remains constant. The lower layer is the "troposphere" where the temperature changes. Nearly all weather occurs in this lower layer which begins at the Earth's surface and extends upwards for 6 to 10 miles.

9-3. Elements Affecting Weather. Weather conditions in the troposphere and on the Earth are affected by four elements: temperature, air pressure, wind, and moisture.

a. Temperature is the measure of the warmth or coldness of an object or substance and, for this discussion, the various parts of the atmosphere. The sunlight entering the atmosphere reaches the Earth's surface and warms both the ground and the seas. Heat from the ground and the seas then warms the atmosphere. The atmosphere absorbs the heat and prevents it from escaping into space. This process is called the greenhouse effect because it resembles the way a greenhouse works. Once the Sun sets, the ground cools more slowly than the air because it is a better conductor of heat. At night the ground is warmer than the air, especially under a clear dry sky. The ground cools more slowly than the humid nights. Temperature changes near the ground for other reasons. Dark surfaces are warmer than light-colored surfaces. Evening air settles in low areas and valleys creating spots colder than higher elevations.

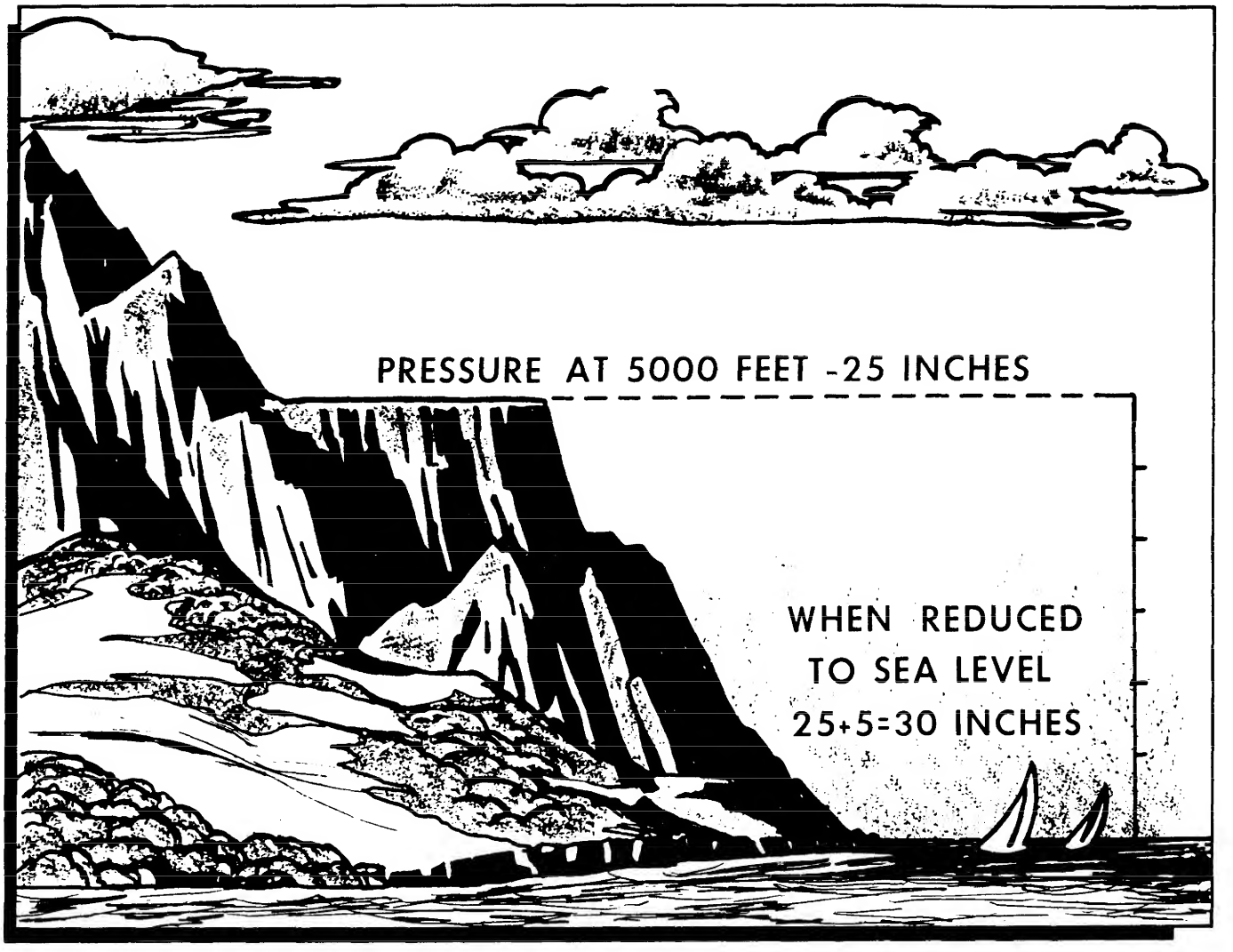


Figure 9-2. Air Pressure.

Seas, lakes, and ponds retain heat and create warmer temperatures at night near shore. The opposite is true during the day, especially in the spring when lakes are cold. On the beach, daytime temperatures will be cooler than the temperatures on land further from shore. Knowing this will help determine where a survivor should build a shelter.

b. Air pressure is the force of the atmosphere pushing on the Earth. The air pressure is greatly affected by temperature. Cool air weighs more than warm air. As a result, warm air puts less pressure on the Earth than does cool air. A low-pressure area is formed by warm air whereas cool air forms a high-pressure area (figure 9-2).

c. Wind is the movement of air from a high-pressure area to a low-pressure area. The larger the difference in pressure, the stronger the wind. On a global scale, the air around the Equator is replaced by the colder air around the poles (figure 9-3). This same convection of air on a smaller scale causes valley winds to blow upslope during the day and down the mountainside at night. Cool air blows in from the ocean during the day due to the heating and rising of the air above the land and reverses at night (figures 9-4 and 9-5). This movement of air creates winds throughout the world. When cool air moves into a low-pressure area, it forces the air that was already there to move upward. The rising air expands and cools.

d. Moisture enters the atmosphere in the form of water vapor. Great quantities of water evaporate each day from the land and oceans causing vapor in the air called humidity. The higher the humidity, the higher the moisture content in the air. Air holding as much moisture as possible is saturated. The temperature at which the air becomes saturated is called the dew point. When the temperature falls below the dew point, moisture in the air condenses into drops of water. Low clouds called fog may develop when warm, moist air near the ground is cooled to its dew point. A cooling of the air may also

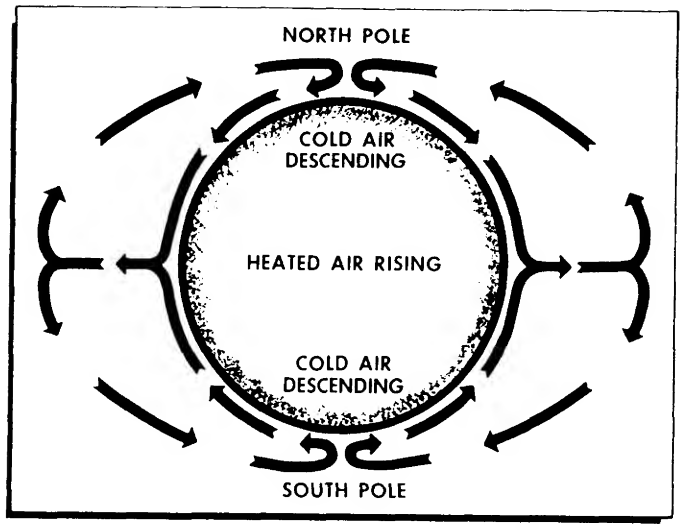


Figure 9-3. Wind Movement.

cause moisture to fall to the Earth as precipitation (rain, snow, sleet, or hail).

9-4. Circulation of the Atmosphere. If the Earth did not rotate, wind would move directly from the high-pressure areas of the poles to the low-pressure areas of the Equator. The movement of air between the poles and the Equator would go on constantly.

a. The rotation of the Earth prevents winds from the poles and the Equator from moving directly north or south. The Earth rotates from west to east, and as a result, winds moving toward the Equator seem to curve toward the west. Winds moving away from the Equator seem to curve toward the east. This is known as the Coriolis effect (figure 9-6). This effect results in winds circling the Earth in wide bands. These prevailing winds are divided into six belts which are known as the trade winds, the prevailing westerlies, and the polar easterlies; all three are found in both the Northern and Southern Hemispheres (figure 9-7).

(1) The winds blowing toward the Equator are known as the trade winds. The air above the Equator is so hot it is always rising. The north and south trade winds move in to take the place of the rising air. The Coriolis effect makes the trade winds appear to move from the east. The weather in the region of the trade winds moves from east to west because of the Earth's rotation. The doldrums is the region where the trade winds from the north and south meet near the Equator. The doldrums is usually calm, but it is quite rainy and may have periods of gusty winds.

(2) The prevailing westerlies blow away from the Equator. They occur north of the trade winds in the Northern Hemisphere and south of the trade winds in the Southern Hemisphere. The prevailing westerlies seem to move from the west because of the Coriolis effect. The weather in the region of these winds blows

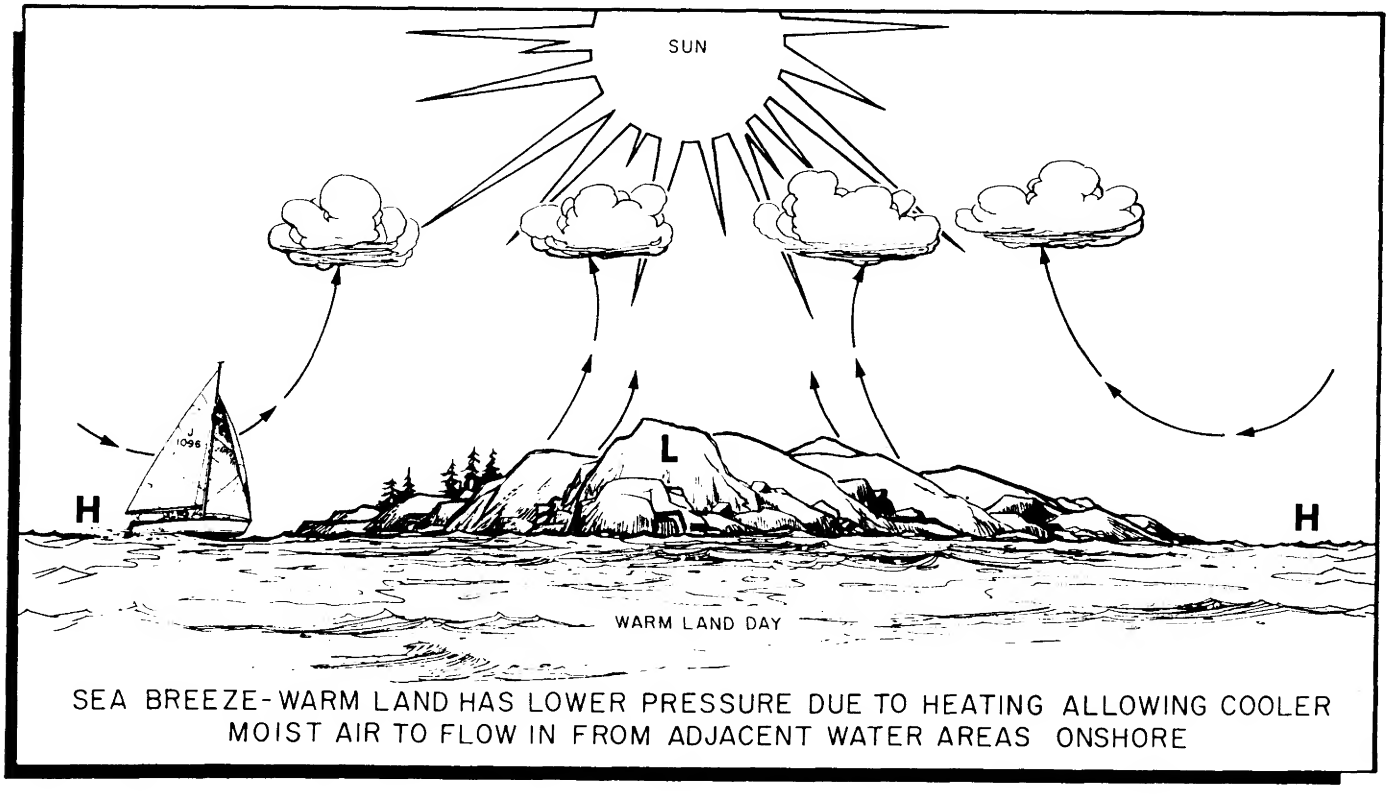


Figure 9-4. Air Transfer (Daytime).

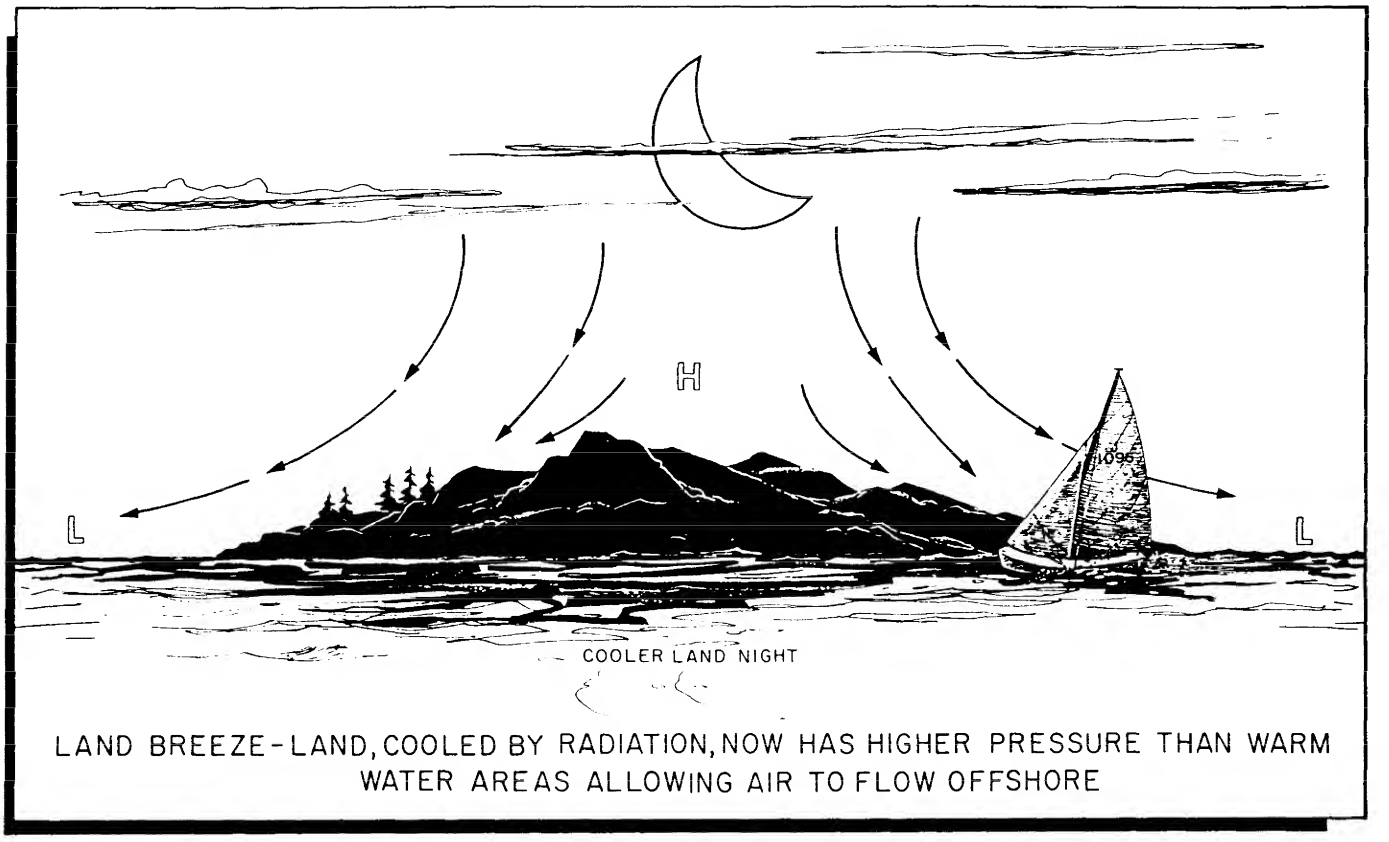


Figure 9-5. Air Transfer (Nighttime).

from west to east. The prevailing westerlies move across most of the United States and Canada, and are divided from the trade winds in a region called the Horse Latitudes. The air in the Horse Latitudes blows downward to fill the space which was left between the prevailing westerlies and the trade winds. The winds are very light in the Horse Latitudes.

(3) The winds from the North and South Poles are known as the polar easterlies. Because the air is so cold, making it heavy, the air above the poles sinks downward. The air spreads out when it reaches the ground and moves toward the Equator. The weather in the region of the polar easterlies moves from east to west with the Coriolis effect making the winds seem to blow from the east. The polar front is the meeting place of the polar easterlies and the prevailing westerlies and is a cloudy, rainy region. Above the polar front is a band of west winds called the jet stream. The jet stream occurs about 5 to 7 miles above the ground. Its winds may exceed 200 miles per hour.

b. Pressure systems are highs or lows covering areas as big as 1 million square miles. Most pressure systems found in the United States and Canada develop along the polar front. There, the cold winds of the polar easterlies and the warmer winds of the prevailing westerlies move past one another and create swirling winds called eddies. These eddies are carried eastward across the United States and Canada by the prevailing westerlies. There are two kinds of eddies: cyclones and anticyclones (figure 9-8).

(1) Cyclones formed by eddies are not the same as the storms known as cyclones. The winds of the eddies that create cyclones swirl inward toward a center of low pressure. A low-pressure system is formed by the cyclone and its low-pressure region. Because of the rotation of the Earth, cyclones that build north of the Equator blow in a counterclockwise direction. Cyclones that form south of the Equator move in a clockwise direction. Cyclones in North America generally approach on brisk winds, bringing cloudy skies and usually rain or snow.

(2) Anticyclones swirl outward around a center of high pressure, forming a high-pressure system. Anticyclones move in a clockwise direction north of the Equator and counterclockwise south of the Equator. Anticyclones come after cyclones, bringing dry, clearing weather and light winds.

c. Airmasses depend largely on the temperature and moisture of the areas in which they originate. Airmasses may cover 5 million square miles. As they move away from their source regions and pass over land and sea, the airmasses are constantly being modified through

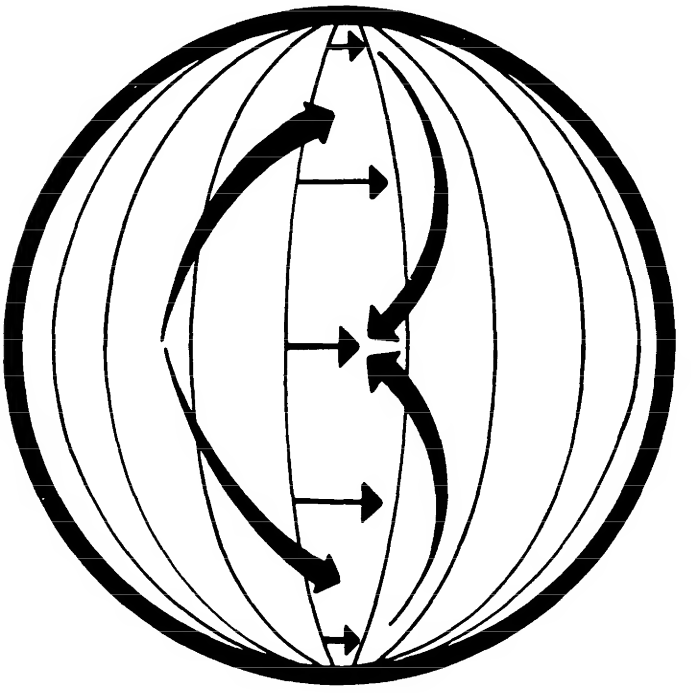


Figure 9-6. Coriolis Effect.

heating or cooling from below, lifting or subsiding, absorbing or losing moisture. In general, however, they retain some of their original characteristics and can be recognized and identified.

(1) There are four major types of airmasses:

(a) Continental polar - cold and dry.

(b) Continental tropical - hot and dry.

(c) Maritime polar - cool and moist.

(d) Maritime tropical - warm and moist.

(2) In North America, the continental polar airmass over northern Canada blows cold, dry air into southern Canada and the United States. Maritime polar airmasses off the northeast and northwest coasts of North America bring cool, damp weather to the continent. Maritime tropical airmasses from the southeast and southwest coasts bring warm, muggy weather. The polar airmasses are strongest in the winter, and the tropical airmasses are strongest in the summer. During the winter, a cold arctic airmass from the North Pole also influences the weather of North America. A continental tropical airmass forms over the southwest United States during the warm months but disappears in the winter.

d. When two different airmasses meet, they do not ordinarily mix (unless their temperatures, pressures, and relative humidities happen to be very similar). Instead, they set up boundaries called frontal zones, or "fronts." The colder airmass moves under the warmer airmass in the form of a wedge. If the boundary is not moving, it is termed a stationary front. Usually, however, the boundary moves along the Earth's surface, and as one airmass withdraws from a given area, it is replaced by another airmass. This action creates a moving front. If warmer air is replacing colder air, the front is called "warm;" if colder air is replacing warmer air, the front is called "cold." Most changes in the weather occur along fronts. The movement of fronts depends on the formation of pressure systems. Cyclones push fronts along at speeds of 20 to 30 miles per hour. Anticyclones blow into an area after a front has passed.

(1) When a warm front moves forward, the warm air slides up over the wedge of colder air lying ahead of it (figure 9-9). This warm air usually has high humidity. As this warm air is lifted, its temperature is lowered. As the lifting process continues, condensation occurs, low nimbostratus and stratus clouds form from which rain develops. The rain falls through the cooler air below, increasing its moisture content. Any reduction of temperature in the colder air, which might be caused by upslope motion or cooling of the ground after sunset, may result in extensive fog. As the warm air progresses up the slope, with constantly falling temperature, clouds appear at increasing heights in the form of altostratus and cirrostratus, if the warm air is stable. If the warm air is unstable, cumulonimbus clouds and altocumulus clouds will form and frequently produce thunderstorms. Finally, the air is forced up near the stratosphere and in the freezing temperatures at that level, the condensation appears as thin wisps of cirrus clouds. The upslope movement is very gradual, rising about 1,000 feet every 20 miles. Thus, the cirrus clouds, forming at perhaps 25,000 feet altitude, may appear as far as 500 miles in advance of the point on the ground which marks the position of the front. Warm fronts produce more gradual changes in the weather than do cold fronts. The changes depend chiefly on the humidity of the advancing warm airmass. If the air is dry, cirrus clouds may form and there will be little or no precipitation. If the air is humid, light, steady rain or snow may fall for several days. Warm fronts usually have light winds. The passing of a warm front brings a sharp rise in temperature, clearing skies, and an increase in humidity.

(2) When the cold front moves forward, it acts like a snowplow, sliding under the warmer air and tossing it aloft. This causes sudden changes in the weather. In fast-moving cold fronts, friction retards the front near the ground, which brings about a steeper frontal surface. This steep frontal surface results in a narrower band of weather concentrated along the forward edge of the front. If the warm air is stable, an overcast sky may occur for some distance ahead of the front, accompanied by general rain. If the warm air is conditionally unstable, scattered thunderstorms and showers may form in the warm air. In some cases, an almost continuous line of thunderstorms is formed and called a "squall line." Behind the fast moving cold front there is usually rapid clearing, with gusty and turbulent surface winds and colder temperatures. The slope of a cold front is much steeper than that of a warm front and the progress

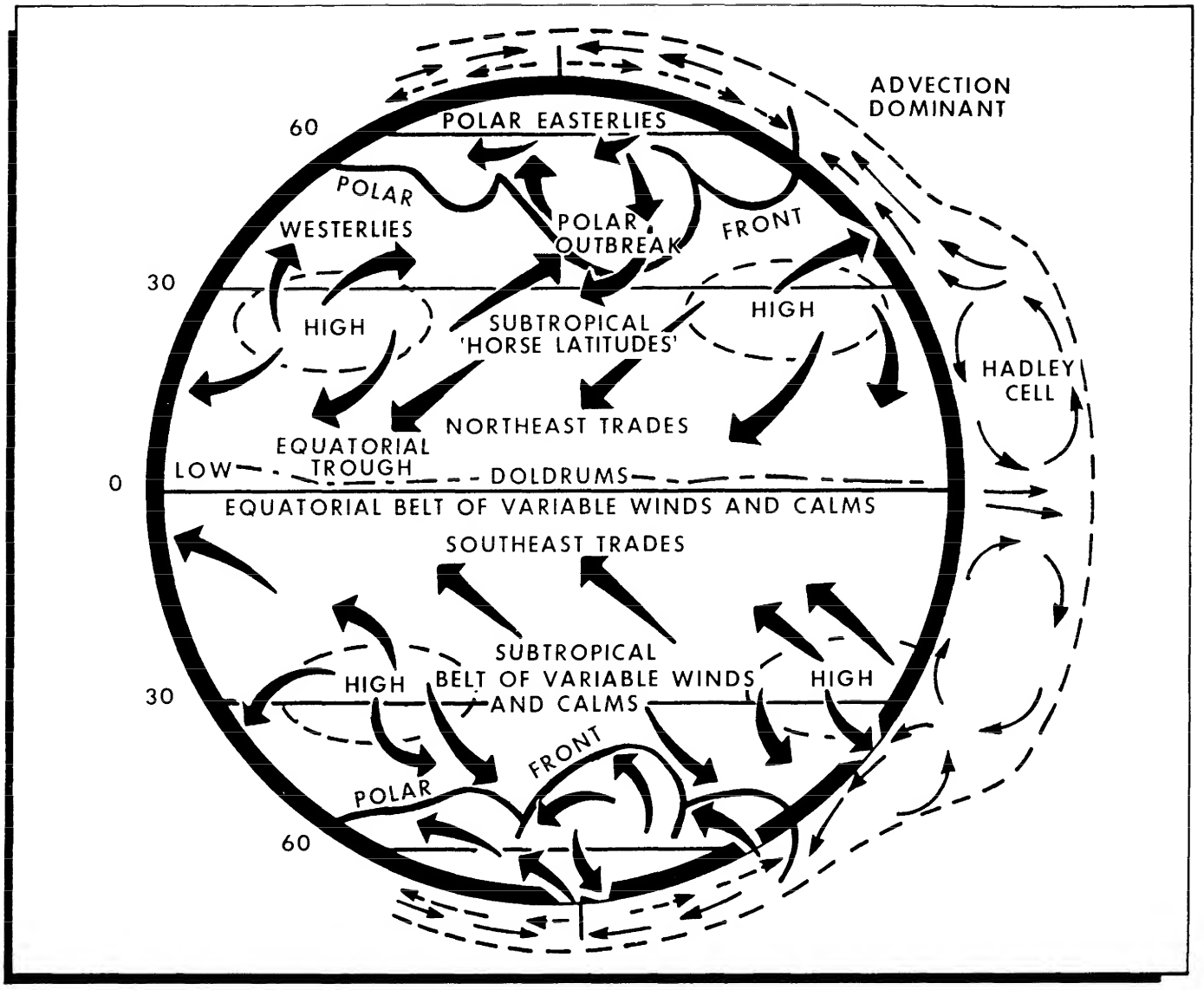


Figure 9-7. Atmosphere Circulation.

is generally more rapid—usually from 20 to 35 miles an hour, although in extreme cases, cold fronts have been known to move at 60 miles per hour (figure 9-10). Weather activity is more violent and usually takes place directly at the front instead of in advance of the front. However, especially in late afternoon during the warm season, a squall line will frequently develop as much as 50 to 200 miles in advance of the actual cold front. Whereas warm front dangers lie in low ceilings and visibilities, cold front dangers lie chiefly in sudden storms with high and gusty winds. Unlike the warm front, the cold front arrives almost unannounced, makes a complete change in the weather within the space of a few hours, and passes on. The squall line is ordinarily quite narrow—50 to 100 miles in width—but is likely to extend for hundreds of miles in length, frequently lying across the entire United States in a line running from northeast to southwest. Altostratus clouds sometimes form slightly ahead of the front, but these are seldom more than 100 miles in advance. After the front has passed, the weather clears rapidly with cooler, drier air.

(3) One other form of front with which the survivor should become familiar is the "occluded front" (figure 9-11). Cold fronts travel about twice as fast as warm fronts. As a result, cold fronts often catch up to warm fronts. When a cold front reaches a warm front, an occluded front develops. Meteorologists subdivide occlusions into two types: cold-front occlusions and warm-front occlusions. In a cold-front occlusion, the air behind the cold front is colder than the air ahead of the warm front. The weather of a cold-front occlusion re-

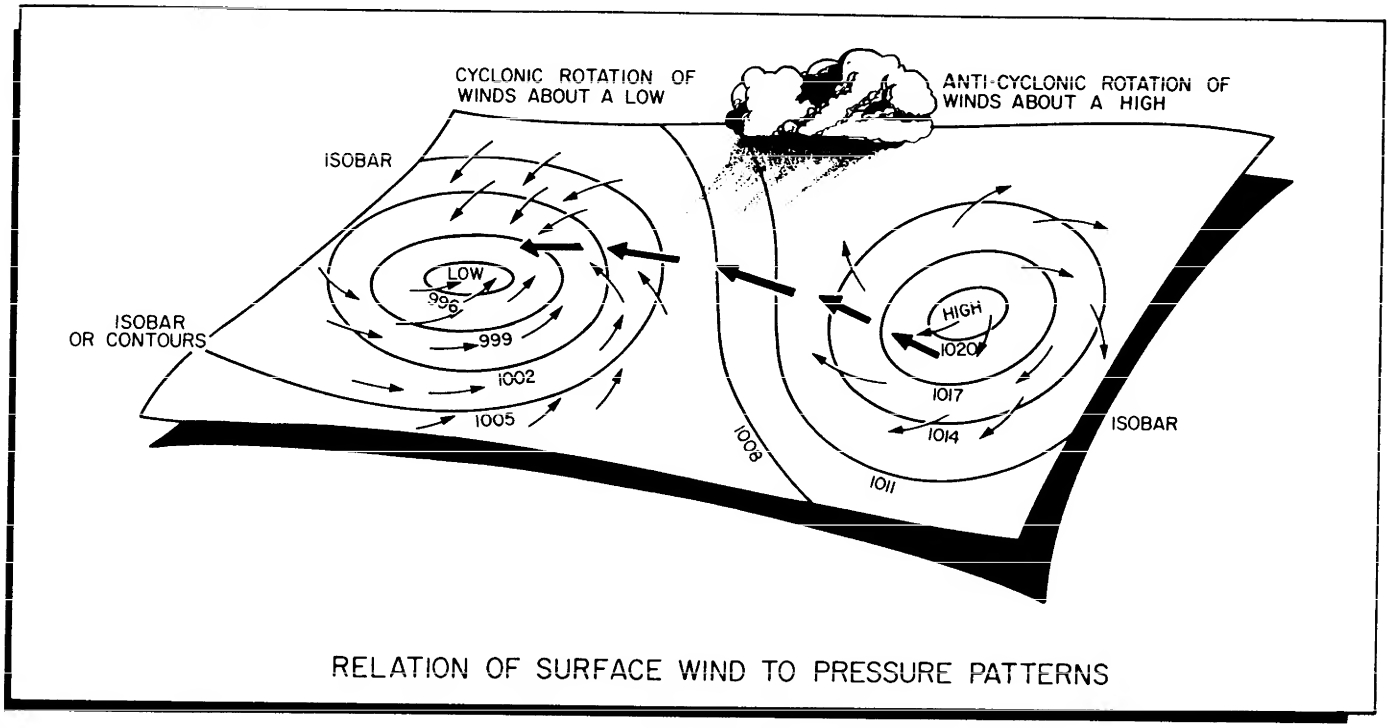


Figure 9-8. Cyclonic and Anticyclonic Rotation.

sembles that of a cold front. When the air behind the cold front is warmer than the air ahead of the warm front, it is known as a warm-front occlusion. Warm-front occlusion weather is similar to a warm front. These fronts produce milder weather than do cold or warm fronts.

(4) Stationary fronts are another type of front which occurs when airmasses meet but move very slow-

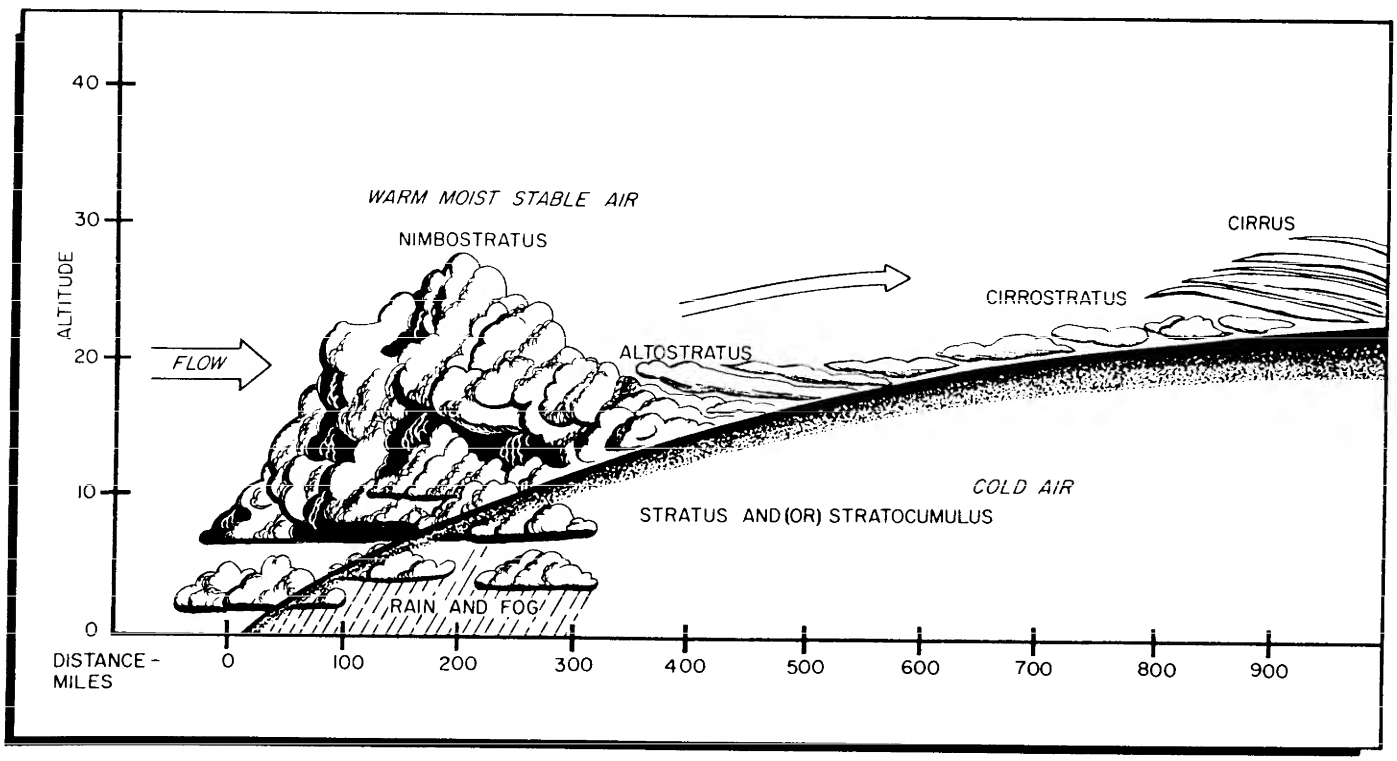


Figure 9-9. Stable Air Warm Front.

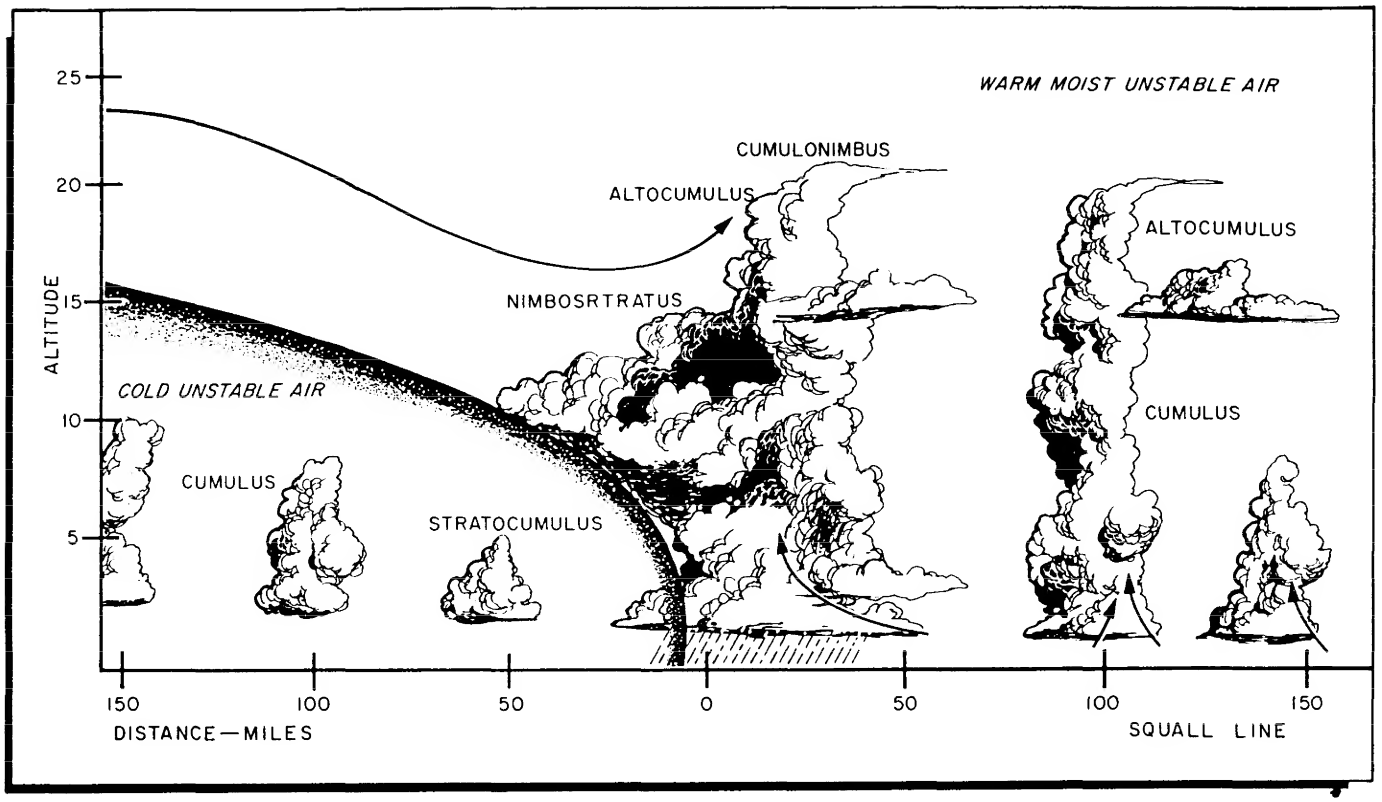


Figure 9-10. Fast-Moving Cold Front.

ly. It may remain over an area for several days bringing moderate weather.

9-5. Storms. The four main types of violent weather a person should be familiar with are thunderstorms, winter storms, tornadoes, and hurricanes.

a. Thunderstorms are the most frequent kinds of storms. As many as 50,000 thunderstorms occur throughout the world each day. Under some conditions, the rapid lifting of moist, warm air results in thunderstorms and dramatic cloud formations (figure 9-12). They develop from tall, puffy cumulonimbus clouds. Clouds may tower 5 to 10 miles high during hot, humid days. The temperatures inside the clouds are well below freezing. The air currents inside the clouds move up and down as fast as 5,000 feet per minute. Heavy rain is common because water vapor condenses rapidly in the air. Lightning and thunder occur during the life of a thunderstorm. When the sound of thunder is heard, a survivor should seek shelter immediately. Lightning causes more fatalities than any other type of weather phenomenon. In the United States alone more than 200 lightning deaths occur each year. Another reason for seeking shelter immediately is to escape the hail which sometimes accompanies the thunderstorm. Hail, which can grow as large as baseballs, is most noted for damaging crops, but a powerful storm can bring injuries, even fatalities, to survivors if shelter is not available.

b. Tornadoes are the most violent form of thunderstorms. Under certain conditions, violent thunderstorms will generate winds swirling in a funnel shape with rotational speeds of up to 400 miles per hour which extends out of the bottom of the thunderstorm. When this funnel-shaped cloud touches the surface, it can cause major destruction. The path of a tornado is narrow, usually not more than a couple of hundred yards wide. Tornadoes form in advance of a cold front and are usually accompanied by heavy rain and thun- southern areas of the United States.

c. Winter storms include ice storms and blizzards. An ice storm may occur when the temperature is just below freezing. During this storm, precipitation falls as rain but freezes on contact with the ground. A coating of ice forms on the ground and makes it very hazardous to the traveler. Snowstorms with high winds and low temperatures are called blizzards. The wind blows at 35 miles per hour or more during a blizzard, and the temperture may be 10°F or less. Blowing snow makes it impossible to travel because of low visibility and drifting.

d. A hurricane or typhoon, the most feared of storms, has a far more widespread pattern than a tornado. The storm forms near the Equator over the oceans and is a

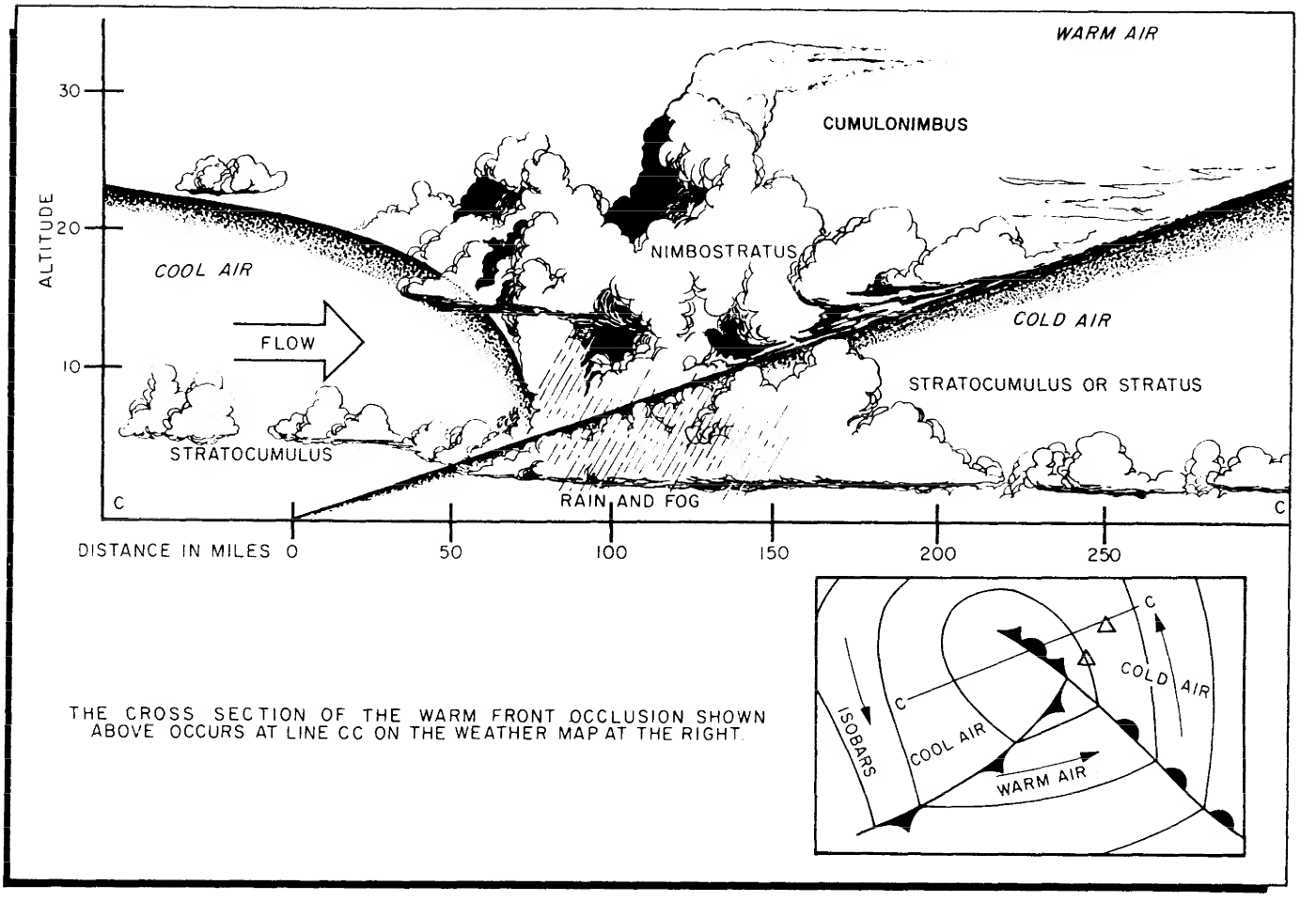


Figure 9-11. A Warm-Front Occlusion.

large low-pressure area, about 500 miles in diameter. Winds swirl around the center (eye) of the storm at speeds over 75 miles per hour and can reach 190 miles per hour. Hurricanes break up over land and often bring destructive winds and floods. Thunderstorms often form within hurricanes and can produce tornadoes. Most hurricanes occurring in the United States sweep over the West Indies and strike the southeastern coast of the country. An early indication of a hurricane is a wind from an unusual direction, like the replacement of the normal flow of the trade winds from an easterly direction. The arrival of high waves and swells at sea coming from an unusual direction may also give some warning. The high waves and swells are moving faster than the storm and may give several days warning.

9-6. Weather Forecasting. Weather forecasting enables survivors to make plans based on probable changes in the weather. Forecasts help survivors decide what clothes to wear and type of shelter to build. During an evasion situation, it may help survivors determine when to travel. While accurate weather prediction or forecasting normally requires special instruments, an awareness of changing weather patterns and attention to existing conditions can help a survivor or evader prepare for and, when appropriate, use changing weather conditions to enhance their survivability. The following are some elementary weather indicators which could help predict the weather and help save lives.

a. Clouds which move higher are good signs of fair weather. Lower clouds indicate an increase in humidity, which in all probability means precipitation (figure 9-13).

b. The Moon, Sun, and stars are all weather indicators. A ring around the Moon or Sun means rain (figure 9-14). The ring is created when tiny ice particles in fine cirrus clouds scatter the light of the Moon and the Sun in different directions. When stars appear to twinkle, it indicates that strong winds are not far off, and will become strong surface winds within a few hours. Also, a large number of stars in the heavens show clear visibility with a good chance of frost or dew.

c. "Low-hanging" clouds over mountains mean a weather change (figure 9-13). If they get larger during

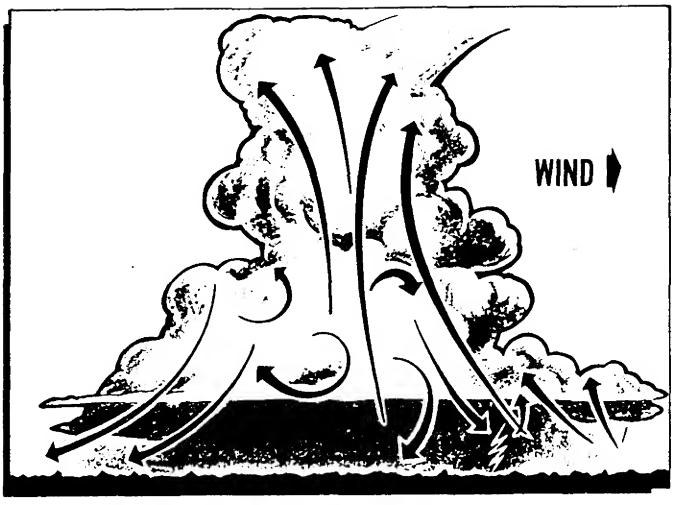


Figure 9-12. Thunderstorms.

the daytime, bad weather will arrive shortly. Diminishing clouds mean dry weather is on its way. Storms are often preceded by high thin cirrus clouds arriving from the west. When these thicken and are obscured by lower clouds, the chances increase for the arrival of rain or snow.

d. The old saying "red skies at night, sailor's delight; red skies at morning, sailors take warning," has validity. The morning Sun turning the eastern sky crimson often signals the arrival of stormy weather. As the storm moves east, clouds may turn red as a clearing western sky opens for the setting Sun.

e. "The farther the sight, the nearer the rain," is a seaman's chant. When bad weather is near, the air pressure goes down and the atmosphere becomes clearer. High atmospheric pressure with stable and dusty air means fair weather.

f. A cold front arriving in the mountains during the summer usually means several hours of rain and thunderstorms. However, the passing of a cold front means several days of clear, dry weather.

g. A morning rainbow is often followed by a squall. An afternoon rainbow means unsettled weather, while an evening rainbow marks a passing storm. A faint rainbow around the Sun precedes colder weather.

h. Stormy weather will probably follow within hours when flowers seem to be much more fragrant.

i. People say "when sounds are clear, rain is near," because sound travels farther before storms.

j. Even birds can help predict the weather. Water birds fly low across the water when a storm is approaching. Birds will huddle close together before a storm.

k. The flowers of many plants, like the dandelion, will close as humidity increases and rain is on the horizon.

l. As humidity increases, the rocks in high mountain areas will "sweat" and provide an indication of forthcoming rain.

m. Lightning can tell survivors something by noting the color and compass direction. If the lightning looks white when seen through clear air and is located in the west or northwest, survivors would know the storm is headed toward them. Storms to the south or east will normally pass to the east. Red or colored lightning is seen at a distance in storms that will pass to the north or south.

n. Smoke, rising from a fire then sinking low to the ground, can indicate that a storm is approaching.

9-7. Summary. Even with the modern equipment available, forecasting tomorrow's weather is often difficult. This chapter provided background information and tips to use to teach survivors to predict weather. By understanding the basic characteristics and actions of weather, the survivor can better prepare for its effects.

Figure 9-13. Low Clouds.

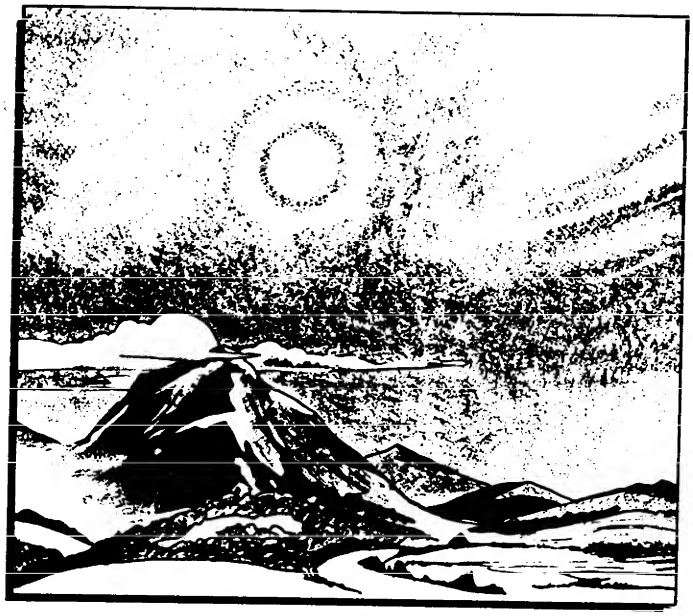


Figure 9-14. Rings Around Moon or Sun.

Chapter 10

GEOGRAPHIC PRINCIPLES

10-1. Introduction. Geographic principles bring together the three major components of the environment (terrain, life forms, and climate) for the purpose of understanding the relationship between survivors and the physical environment around them. The more survivors know about these environmental components, the better they can help themselves in a survival situation. This chapter provides a brief introduction to these complex topics.

10-2. Components of the Environment:

a. Terrain is defined as a geographic area consisting of land and its features. The landmass of the Earth is covered with a variety of topography, including mountains, valleys, plateaus, and plains.

(1) The mountains vary greatly in size, structure, and steepness of slopes. For example, there is as much contrast between the large volcanic Cascade Mountains and those of the Rocky Mountains as there is between the Rocky Mountains and the Appalachian Mountains. Most major mountain systems will have corresponding foothills (figure 10-1).

(2) With two exceptions, valleys are formed as mountains are pushed up. The exceptions are massive gorges formed by glacial action and valleys carved out by wind and water erosion (figure 10-2).

(3) Plateaus are elevated and comparatively large, level expanses of land. Throughout the southwest, examples of the typical plateau can be seen. These plateaus were formed when a volcano deposited either lava or ash over a softer sedimentary area. Through years of erosion, the volcanic "cap" broke loose in places and allowed the softer ground to be carried away. This type of plateau is the least common; however, it is the largest. The Columbia Plateau of Washington State is one example which covers 200,000 square miles (figure 10-3).

(4) The water forms of the Earth include oceans, seas, lakes, rivers, streams, ponds, and ice.

(a) Oceans comprise approximately 70 percent of the Earth's surface. The major oceans include the Pacific, Atlantic, Indian, and Arctic. Oceans have an enormous effect on land, not only in their physical contact but in their effect on weather. In most cases, lakes today are descended from much larger lakes or seas.

(b) Ice covers 10 percent of the Earth's surface. This permanent ice is found in two forms—pack ice and glaciers. Pack ice (normally 7 to 15 feet thick) is frozen sea water and may be as much as 150-feet thick. Those pieces which break off form ice islands. The two permanent icepacks on Earth are found near the North and South Poles—Arctic and Antarctic. The polar regions, which are thousands of feet thick, partially, but never completely, thaw. An icecap is a combination of pack ice and ice sheets. The term is usually applied to an ice plate limited to high mountain and plateau areas. During glacial periods, an icecap will spread over the surrounding lowlands (figure 10-4).

b. Life forms can best be described in terms of vegetation and animal life, with special emphasis on humans (which are covered later).

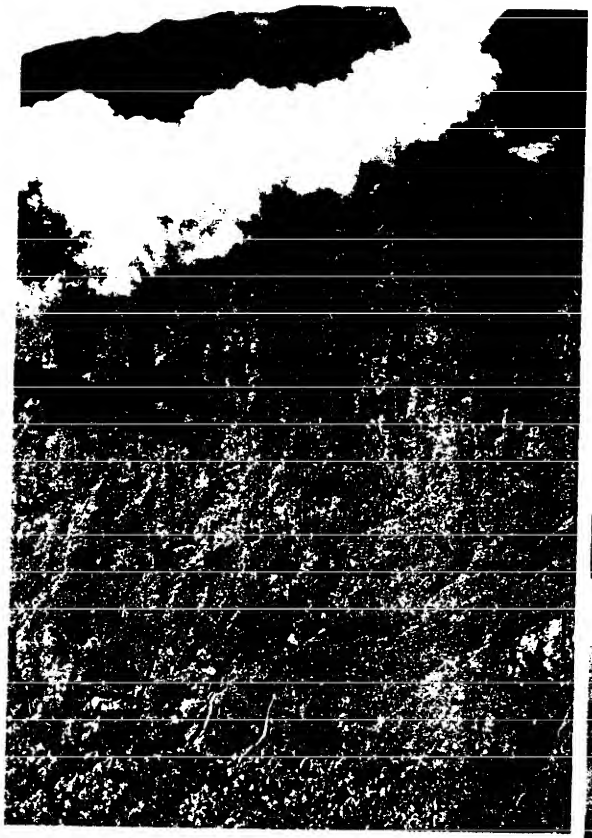
(1) There are hundreds of plant species on Earth. An in-depth study is obviously impossible. To understand the plant kingdom better, it is important to understand basic plant functions and adaptations they have made to exist in diverse environments. Vegetation will be categorized into either trees or plants.

(a) Of all the variety in species and types, trees can be divided simply into two types: coniferous or deciduous. Conifers are generally considered to be cone-bearing, evergreen trees. Some examples of conifers are pine, fir, and spruce. Deciduous trees are those which lose their leaves in winter and are generally considered as "hardwood." Some examples are maple, aspen, oak, and alder.

(b) For discussion, we will divide plants into two categories: annuals and perennials. Annuals complete their life cycle in 1 year. They produce many seeds and regenerate from seed. Climatic conditions may not be conducive for growth the following year, so seeds may remain dormant for many years. A classic example is the 1977 desert bloom in Death Valley. Plants bloomed for the first time in 80 years. Perennials are plants which last year after year without regeneration from seed.

(2) As with plants, the discussion of animal life has to be limited. Animals will be classified as either warmblooded or coldblooded. Using this division as a basic, it will be easier to describe animal adaptations to extreme climatic conditions. Warmblooded animals are generally recognized as cold-adapted animals and include all birds and mammals. Obviously, humans are a part of this classification because they are cold-adapted. Coldblooded animals gain heat from the environment. These are animals adapted for life in warm or moderate climates (lizards, snakes, etc.)

c. Climate can be described as an average condition of the weather at any given place. However, this description must be expanded to include the seasonal variations and extremes as well as the averages in terms of the climatic elements. In some areas, the climate is so domineering that the corresponding biome is named either in part or as a whole by the climate. Examples are the cloud forests and rain forests. The climate can only be described in terms of its various elements—temperature, moisture, and wind.



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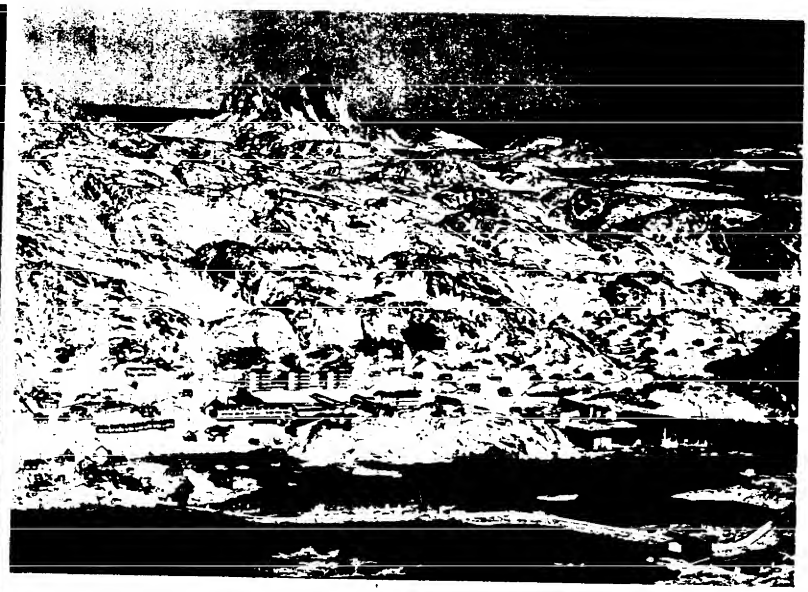

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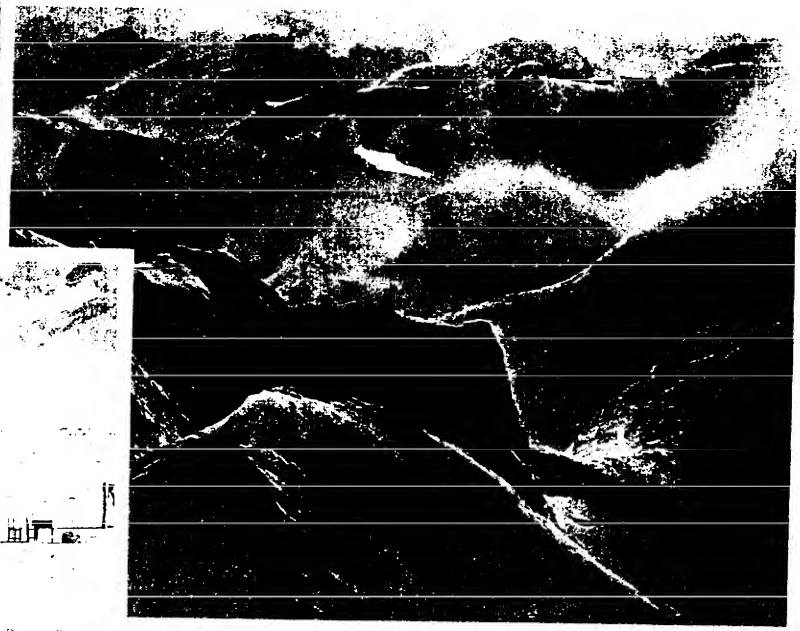

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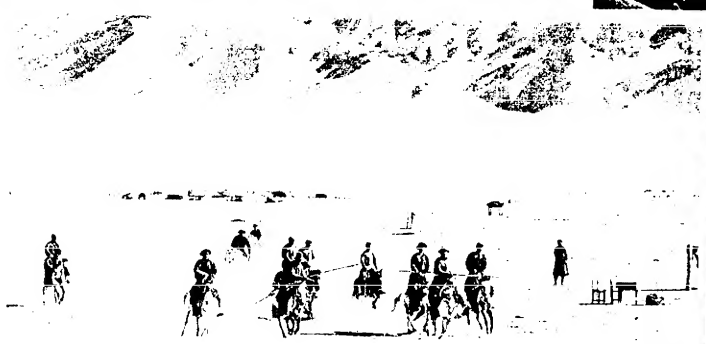

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Figure 10-1. Composite of Mountains.

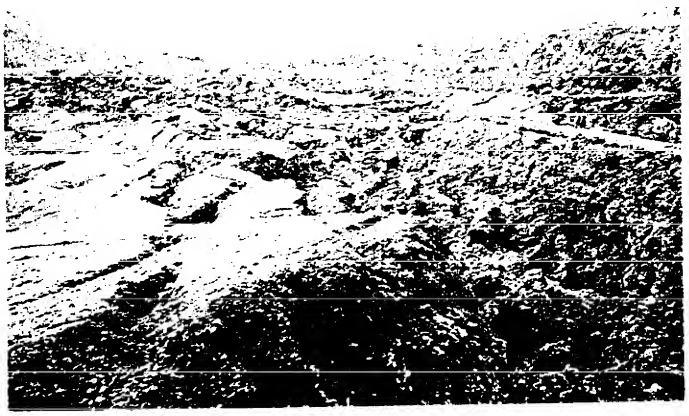


Figure 10-2. Gorges and Valleys.

(1) The atmosphere gains only about 20 percent of its temperature from the direct rays of the Sun. Most of the atmospheric heat gain comes from the Earth radiating that heat (energy) back into the atmosphere and being trapped. This is known as the greenhouse effect.

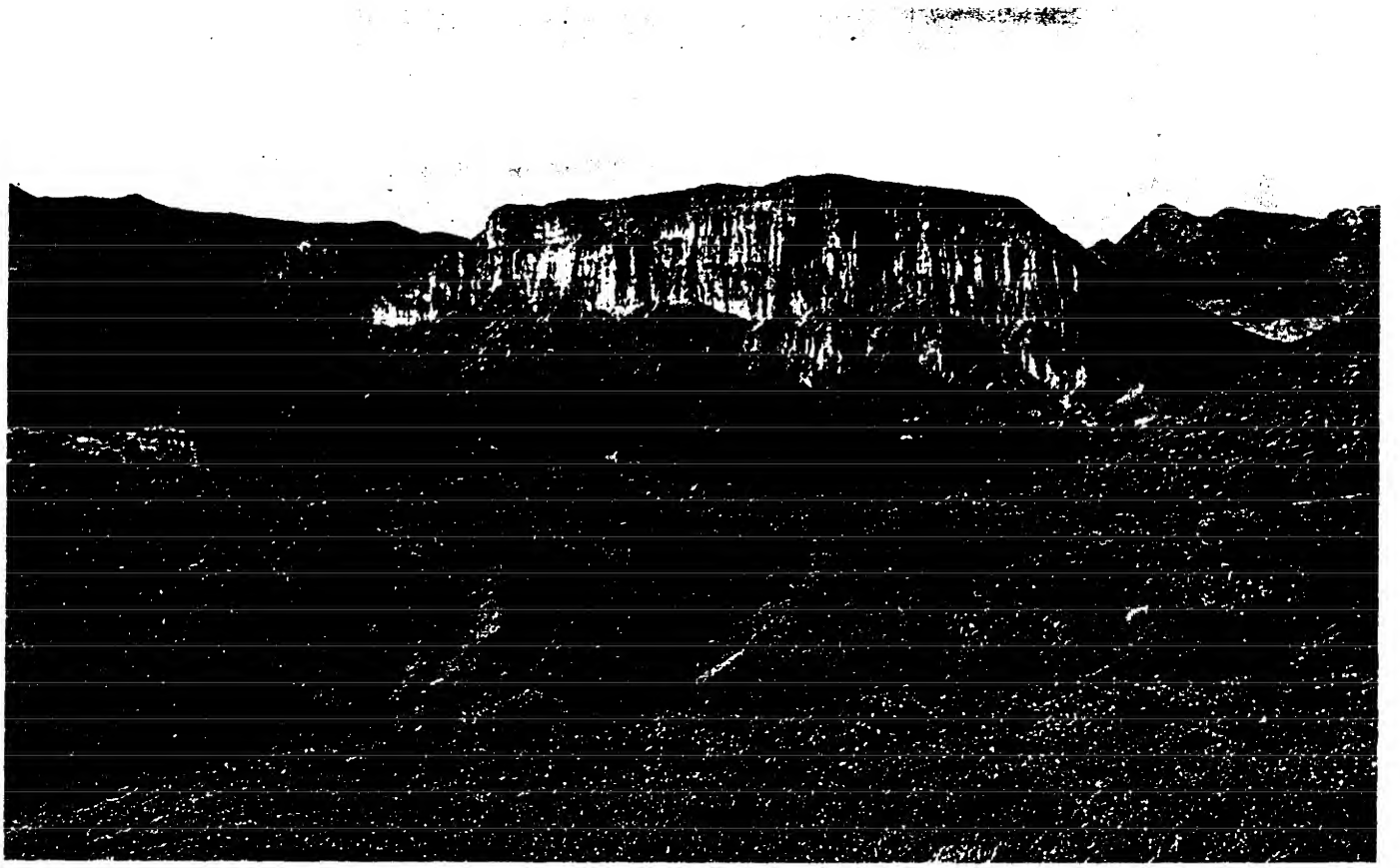


Figure 10-3. Plateau.

(2) Thinking of the atmosphere as a greenhouse, it is easier to understand the relationship water has in this "closed system." As water evaporates, the amount of water vapor the atmosphere can absorb depends solely upon temperature. The dew point is achieved when the amount of water vapor in the air equals the maximum volume the air will hold at a given air temperature. Lowering of air temperature creates condensation. Condensation appears in the form of clouds, fog, and dew. Any additional temperature reduction results in precipitation, such as rain. If the temperature of the dew point is below freezing, precipitation may appear in the form of hail or snow.

(3) Variation in air pressure is the primary cause of wind. When air is heated, it creates an area of lower pressure. As air cools, the pressure increases. Air movement occurs as the pressure tries to equalize, thus creating wind. Because wind is also a control of climate, people need to know why and how it affects climate. Let's look at wind in two aspects: localized wind (low altitude) and upper-air wind (high altitude). Localized wind is formed at low altitude, occurring due to dynamic topographical features and fluctuating air temperature and pressure. High-altitude winds surrounding the Earth are bands of stable high- and low-pressure areas (cells). Predictable winds move off these cells which are referred to as jetstreams. These high-altitude winds control weather.

10-3. Effects of Climate on Terrain. The major effect climate has on terrain is erosion. Erosion can occur directly from heavy precipitation or indirectly by the accumulation of snow on snowpacks and glaciers. Wind and temperature both have erosion potential.

a. Heavy precipitation or melting water from icepacks and glaciers can create deep ravines by cutting into mountainous areas. Broad flood basins along major rivers can also aid in the development of river deltas in lakes, oceans, and deep fjords. The action of glaciers throughout the years has carved out deep, broad valleys with steep valley walls (figure 10-5).

b. The effects of wind erosion are greatest in barren, dry areas. The Great Arches National Park has some of the most dramatic examples of the effect of wind erosion. This type of erosion is caused by the wind driving sand and dust particles against an exposed rock or soil

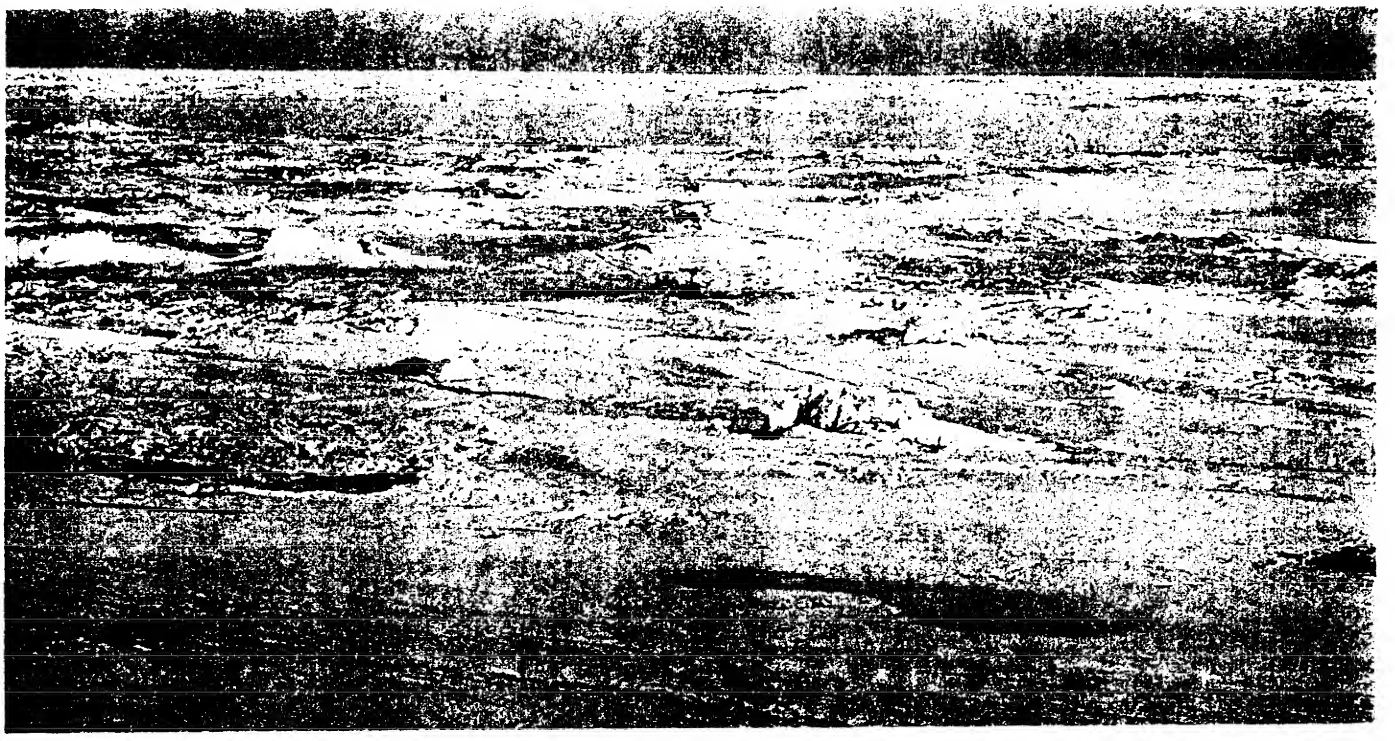


Figure 10-4. Pack Ice.

surface, causing it to be worn away by the impact of the particles in an abrasive action (figure 10-6). Another form of wind erosion involves the movement of loose particles lying upon the ground surface which may be lifted into the air or rolled along the ground. Dry river beds, beaches, areas of recently formed glacial deposits, and dry areas of sandy or rocky ground are highly susceptible to this type of erosion. Sand dunes are attributed to this phenomenon (figure 10-7).

c. Frost action will have a weathering or eroding effect on rock land formations and ground surfaces. The frost action is the repeated growth and melting of ice crystals in the pore space or fractures of soil and rock. The tremendous force of growing ice crystals can exert a pressure great enough to pry apart rock. Many scree and talus slopes are caused by this action. Where soil water freezes, it tends to form ice layers parallel with the ground surface, heaving the soil upward unevenly. The peat moss mounds of the tundra are an example of this action. The net effect of frost action will be dependent on the amount of surface moisture.

10-4. Effects of Terrain on Climate. The effect of terrain on climate is not nearly as subtle as the effect of climate on terrain. Three major factors exist which must be considered when studying the effects of terrain on weather.

a. Moisture for most major weather systems comes from the evaporation of the oceans of the world. The temperature, location, and flow of ocean currents, combined with the prevailing winds will affect how much water will evaporate into the atmosphere. The warmer the ocean and corresponding current, the greater the rate of evaporation. Since the currents are deflected by landmasses, many warm currents flow parallel to major continents. When this moisture is blown inland by the prevailing winds, the net effect is the creation of a wet maritime climate, such as that found along the west coasts of Canada, Washington, Oregon, and Central Europe. If the temperature of the ocean and currents is cold, very little moisture will be yielded to the atmosphere. Examples of this occur along the Pacific coastline of Peru and Chile and along the Atlantic coastline of Angola and Southwestern Africa.

b. The interior of large continent masses are dry because of the distance which isolates them from the effects of maritime climates. The large continents of the Northern Hemisphere create dry, high-pressure cells which isolate the interiors from the lower pressure moist air cells and keep them from having much effect. The climate is referred to as the Continental Climate. The concept will be explained in the next chapter—Environmental Characteristics.

c. Mountains serve as moisture barriers, separating the maritime influenced climates from the continental influenced climates. The barrier effect of mountains on weather will be dependent on the height, length, and width of the range and the severity of the weather

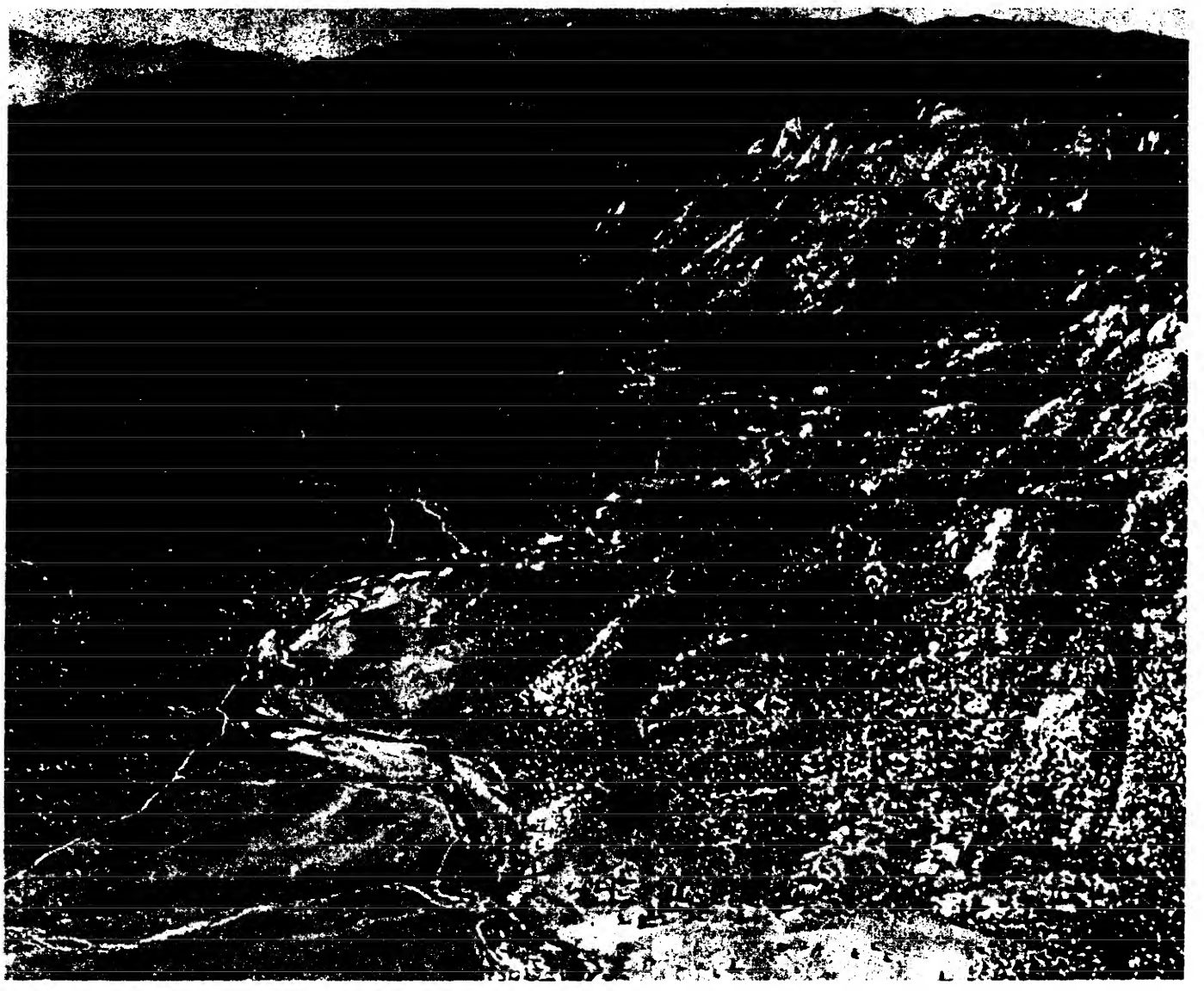


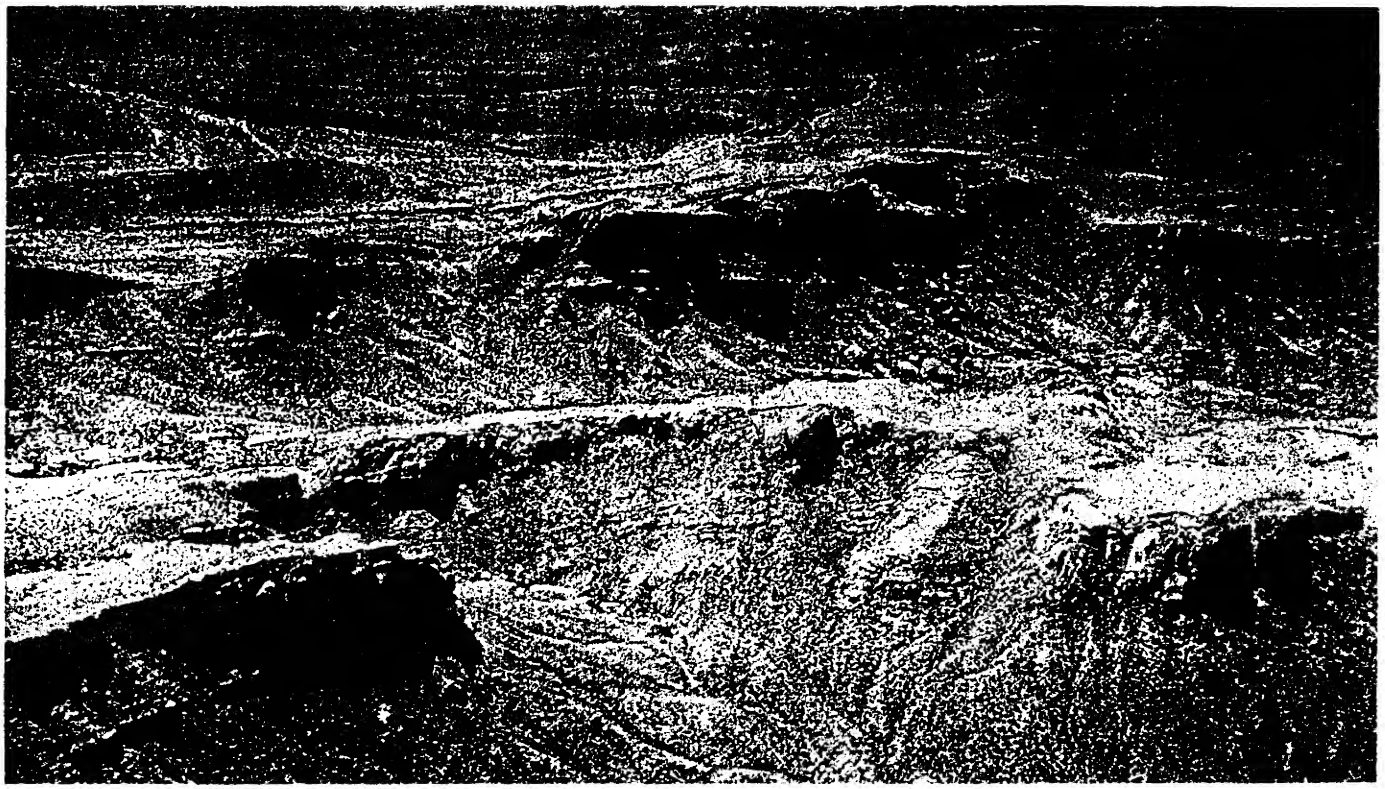
Figure 10-5. Valleys.

fronts. In many cases, a lack of precipitation will extend for several hundred miles beyond the mountains. An example of this phenomenon occurs in the western states. The Cascade and Sierra Mountains block a great deal of Pacific Ocean moisture from the the inland deserts of Washington, Oregon, and Nevada. The Rocky Mountains further block most of the moisture which is left in the atmosphere. Only the high cirrus clouds escape the barrier effect of these mountains. Another example can be seen in Asia. The Himalayan Mountains serve as a very effective barrier, blocking the Asiatic monsoon from central interior Asia, which helps create the Gobi Desert.

10-5. Effects of Climate and Terrain on Life Forms:

a. Since plants require water and light, climate will greatly affect the type and number of plants in an area.

(1) In areas with a great deal of rainfall, plants will be plentiful. In these areas, plants must compete for available sunlight. In areas where the primary vegetation has been knocked down (by clear cutting, landslides, or along flood basins of rivers), a thick secondary growth will occur. In time, the secondary growth, if undisturbed, will become a climax forest. Some of the trees in these areas may grow to 300 feet. Because of the shade, vines and shade-tolerant perennials may sparsely cover the ground.



Bureau of Mines U.S. Dept. of the Interior. Photo by Andrew M. Leszcykowski

Figure 10-6. Erosion.

(2) In contrast, in areas where the amount of rainfall is limited, the plants must compete for the available water. The number of plants will also be sparse. Due to the harsh climatic and soil conditions, plant life is typically hardy. Through millions of years of evolution, plants have developed the following survival characteristics:

(a) Production of many seeds which germinate when water does come.

(b) Shallow root systems gather water quickly when they can.

(c) Ability to store water (cacti and other succulents).

(d) Rough, textured leaves (transpiration).

(e) Production of toxins (kill off competing plants).

b. Vegetation is also affected by the terrain. In mountainous regions, the clouds begin to lose moisture as they pass over the tops of the mountains. The result is more water is available for the growth of vegetation. However, with any increase in elevation, the temperature becomes colder. This exposure to colder temperature has a drastic effect on plant life.

c. Generally, animal life is mostly dependent on two factors: water and vegetation. The greater the rainfall, the greater the number of animals. Conversely, the drier an area, the less vegetation there will be to support animals. The location of small animals is determined by the secondary growth and gound cover, used for protection.

d. Temperature also affects the habits of animals. For example, animals may burrow to protect themselves from extreme heat or extreme cold or will be more active at night in hot, dry regions. Animals also respond physiologically to temperature extremes. During extreme cold, some species of mammals enter into a state of winter dormancy (hibernation). It is a special case of temperature regulation in which animals lower the setting of their "thermostats" to maintain lower than normal body temperatures in order to save energy while maintaining minimum body functions essential for survival. This is important since their normal food supply is not always available during the winter. During periods of excessive heat, some species of fish, reptiles, mammals, and amphibians will enter into a "summer sleep" called estivation. Estivation is a state in which the animal's body functions and activities are greatly reduced. Estivation and hibernation are not merely a result of temperature regulation but rather are methods by which the organisms survive unfavorable periods.

Figure 10-7. Sand Dunes.

Chapter 11

ENVIRONMENTAL CHARACTERISTICS

11-1. Introduction. Most survivors will not have a choice as to where they have to survive. The ease or difficulty in maintaining life and honor and returning are dependent on the types and extremes of the climate, terrain, and life forms in the immediate area. The Köppen-Geiger System of Climate Classification will be used in this chapter as the basis for organizing the discussion of environmental characteristics. This system has become the most widely used of climatic classifications for geographical purposes.

11-2. The Köppen-Geiger System. This system defines each climate according to fixed values of temperature and precipitation, computed according to the averages of the year or of individual months. A climate system based on these data has a great advantage in that the area covered by each subtype of climate can be outlined for large parts of the world. The five major climate groups are designated as: (See figure 11-1.)

a. Tropical Climates. Average temperature of each month is above 64.4°F. These climates have no winter season. Annual rainfall is large and exceeds annual evaporation.

b. Dry Climates. Potential evaporation exceeds precipitation on the average throughout the year. No water surplus; hence, no permanent streams originate in dry climate zones.

c. Warm Temperate Climates. Coldest month has an average temperature under 64.4°F, but above 26.6°F. The warm temperate climates thus have both a summer and winter season.

d. Snow Climates. Coldest month average temperature under 26.6°F. Average temperature of warmest month above 50°F.

e. Ice Climates. Average temperature of warmest month below 50°F. These climates have no true summer.

11-3. Tropical Climates:

a. Tropics. Some people think of the tropics as an enormous and forbidding tropical rain forest through which every step taken must be hacked out and where every inch of the way is crawling with danger. Actually, much of the tropics is not rain forest. What rain forest there is must be traveled with some labor and difficulty. The tropical area may be rain forest, mangrove or other swamps, open grassy plains, or semi-dry brushland. The tropical area may also have deserts or cold mountainous districts. There is in fact, a variety of tropical climates. Each region, while subject to the general climatic condition of its own zone, may show special modifications locally. Each general climate is a whole range of basic minor climates. In all their diversity, the climates of the tropics have the following in common:

(1) An almost constant length of day and night, a length that varies by no more than half an hour at the Equator to 1 hour at the limits of the tropics. The plant life thus has an evenly distributed period of daylight throughout the year.

(2) Temperature variation throughout the tropics is minimal—9°F to 18°F.

(3) There is no systematic pattern of major tropical landforms. There are high rugged mountains; such as the Andes of South America, karst formations as in Southeast Asia, plateaus like the Deccan of India, hilly lands like those which back the Republic of Guinea in Africa, and both large and small plains like the extensive one of the upper Amazon River or the restricted plain of the Irrawaddy River in Burma. The arrangement of all these landforms is part of the pattern of the larger landmasses, not of the tropics alone.

b. Vegetation:

(1) The jungles in South America, Asia, and Africa are more correctly called tropical rain forests. These forests form a belt around the entire globe, bisected somewhat equally by the Equator. However, the tropical rain forest belt is not a continuous one, even in any of the various regions in which it occurs. Usually it is broken by mountain ranges, plateaus, and even by small semi-desert areas, according to the irregular pattern of climate which regulates the actual distribution of rain forest.

(2) Some of the leading characteristics of the tropical rain forest common to those areas in South America, in Asia, and in Africa, are:

(a) Temperatures average close to 80°F for every month.

(b) Vegetation consists of three stories.

(c) High rainfall (80 inches or more) distributed fairly evenly throughout the year.

(d) Areas of occurrence lie between 23.5 North and 23.5 South Latitudes.

(e) Evergreen trees predominate; many of large girth up to 10 feet in diameter, with thick leathery leaves.

(f) Vines (lianas) and air plants (epiphytes) are abundant.

(g) Herbs, grasses, and bushes are rare in the understory.

(h) Uniformity.

(i) Tree bark thin, green, smooth, and usually lacking fissures.

(3) The majority of plants that grow in the forest of the rainy tropics are woody and of the dimensions of trees. Trees form the principal elements of the vegeta-

Figure 11-1. Köppen-Geiger System.

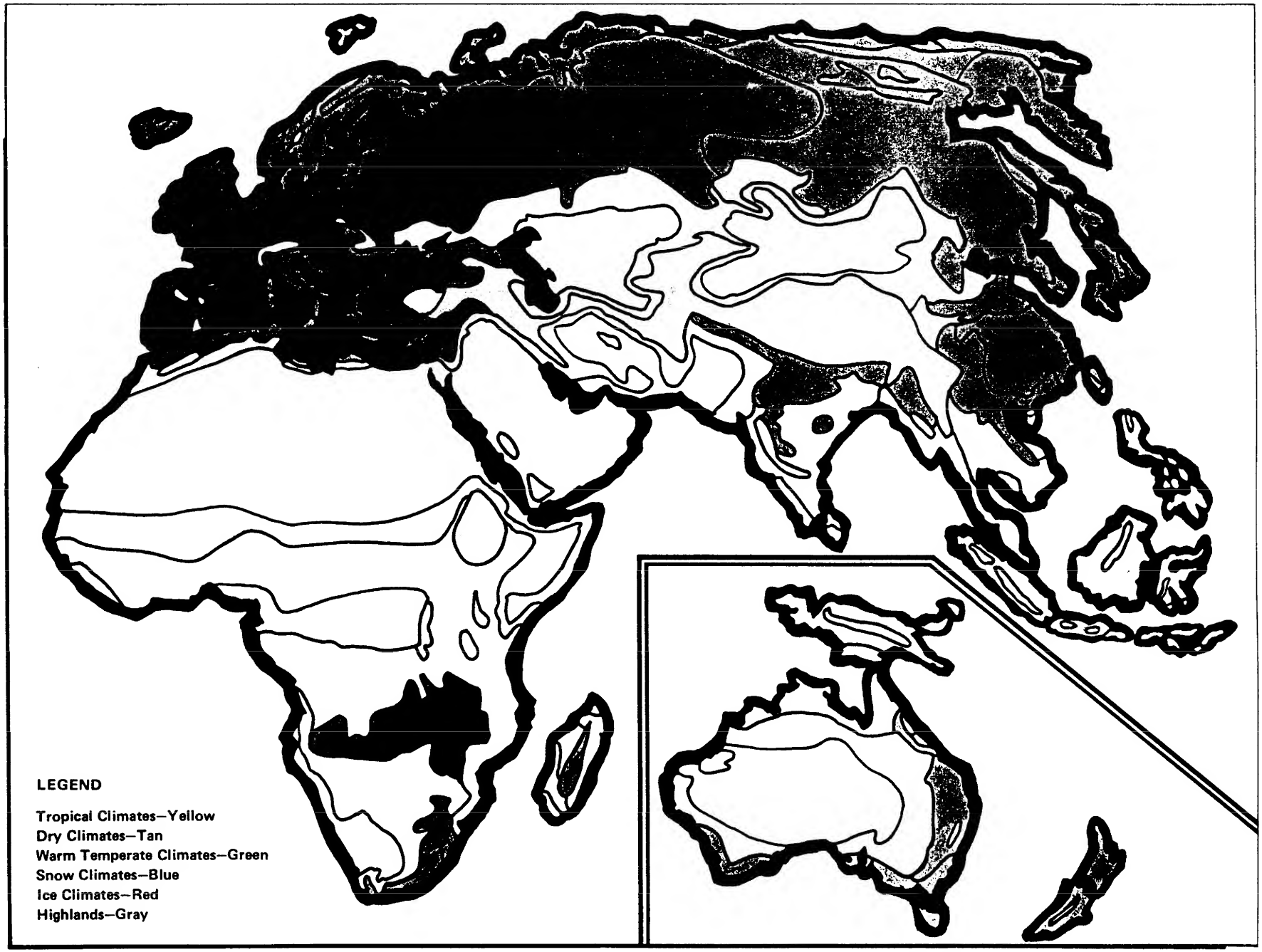


Figure 11-1. Köppen-Geiger System. (cont)

tion. The vines and air plants that grow on the trunks and branches of trees are woody. Grasses and herbs, which are common in the temperate woods of the United States, are rare in the tropical rain forest. The undergrowth consists of woody plants—seedling and sapling trees, shrubs, and young woody climbers. The bamboos, which are really grasses, grow to giant proportions, 20 to 80 feet high in some cases. Bamboo thickets in parts of some rain forests are very difficult to penetrate. The plants that produce edible parts in the jungle are often scattered, and require searching to find several of the same kind. A tropical rain forest (figure 11-2) has a wider variety of trees than any other area in the world. Scientists have counted 179 species in one 8.5-acre area in South America. An area this size in a forest in the United States would have fewer than seven species of trees.

(4) The average height of the taller trees in the rain forest is rarely more than 150 to 180 feet. Old giants of the tropical rain forest attain 300 feet in height, but this is extremely rare. Trees more than 10 feet in diameter are also rare in the jungle. The trunks are, as a rule, straight and slender and do not branch until near the top. The base of many trees is provided with plank buttresses, flag-like outgrowths which are common in all tropical forests. The majority of mature tropical trees have large, leathery, dark-green leaves which resemble laurel leaves in size, shape, and texture. The general appearance is monotonous, and large and strikingly colored flowers are uncommon. Most of the trees and shrubs have inconspicuous flowers, often greenish or whitish.

(5) Travel books often give a misleading impression of the density of tropical forests. On riverbanks or in clearings, where much light reaches the ground, there is a dense growth which is often quite impenetrable. But in the interior of an old undisturbed forest, it is not difficult to walk in any direction. Photographs give an exaggerated notion of the density of the undergrowth. It is usually possible to see another person at least 60 feet away.

(6) The abundance of climbing plants is one of the characteristic features of rain forest vegetation. The great majority of these climbers are woody and many have stems of great length and thickness. Stems as thick as a man's thigh are not uncommon. Some lianas cling closely to the trees that support them, but most ascend to the forest canopy like cables or hang down in loops or

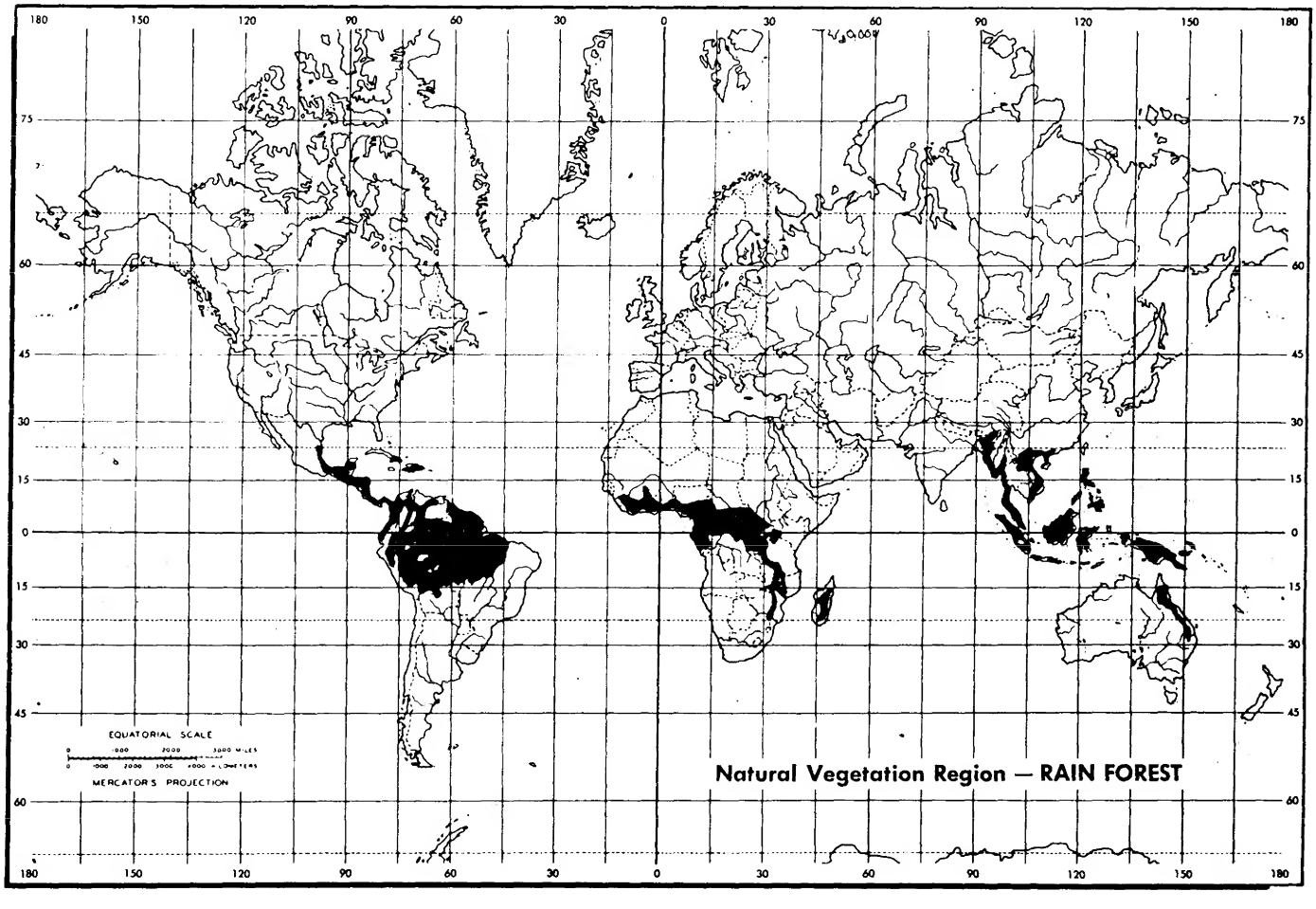


Figure 11-2. Rain Forest.

festoons. In the rain forest, there is no winter or spring, only perpetual midsummer. The appearance of the vegetation is much the same at any time of year. There are seasons of maximum flowering during which more species bloom than at any other time, and also seasons of maximum production of young leaves, plant growth, and reproduction is continuous and some flowers can be found at any time. The margins of a tropical rain forest clearing and areas around abandoned dwellings abound in edible plants. However, in the center of the virgin rain forest, trying to find food is more difficult due to accessibility. The lofty trees are so tall that fruits and nuts are generally out of reach.

c. Distribution of Tropical Rain Forests:

(1) In the Americas, the largest continuous mass of rain forest is found in the basin of the Amazon River. This extends west to the lower slopes of the Andes and east to the Atlantic coast of the continent; it is broken only by relatively small areas of savanna and deciduous forest. This great South American rain forest extends south into the region of the Gran Chaco (south-central South America) and north along the eastern side of Central America into southern Mexico and into the Antilles chain of the West Indies. In the extreme northwest of South America (Ecuador, Colombia), there is a narrow belt of rain forest, separated from the Amazonian forest by a wide expanse of deciduous forest, extending from about latitude 6 degrees South to a little beyond the Tropic of Capricorn. The distribution of rain forest in Central America is perhaps less well known than any other major tropical region. The main areas are below the 500-foot elevation (figure 11-3).

Figure 11-3. Rain Forest (El Salvador).

Figure 11-4. Rain Forest (Borneo).

(2) In Africa, the largest area of rain forest lies in the Congo basin and extends westward into the Republic of Cameroon. As a narrow strip, the forest continues still farther west, parallel to the Gulf of Guinea, through Nigeria and the Gold Coast of Liberia and Guinea. Southward from the Congo basin, the forest extends towards Rhodesia.

(3) In the eastern tropics, the rain forest extends from Ceylon and Western India to Southeast Asia and the Philippines, as well as through the Malay Archipela-

go to New Guinea. The largest continuous areas are in New Guinea, the Malay Peninsula, and the adjoining islands of Sumatra and Borneo, where the Indo-Malayan rain forest reaches its greatest luxuriance and floral wealth (figure 11-4).

(a) In India, the area of rain forest is not large, but it is found locally in the western and eastern Ghats (coastal ranges) and, more extensively, in the lower part of the eastern Himalayas, the Khasia hills, and Assam.

(b) In Burma and Southeast Asia, the rain forest is developed only locally; the principal vegetation being the monsoon forest. The monsoon forest is a tropical type which is partly leafless at certain seasons.

(c) In the eastern Sunda Islands from western Java to New Guinea, the seasonal drought (due to the dry east monsoon from Australia) is too severe for the development of a rain forest, except in locally favorable situations (figure 11-5).

(d) In Australia, the tropical rain forest of Indo-Malaya is continued south as a narrow strip along the eastern coast of Queensland. Rain forest also extends into the islands of the western Pacific (Solomons, New Hebrides, Fiji, Samoa, etc.). (See figure 11-6.)

d. Food Plants. Some of the available food plants in the rain forest include:

(1) Indian or Tropical Almond.
(2) Rose Apple.
(3) East Indian Arrowroot.
(4) Bullock's Heart.
(5) Sugar Cane.
(6) Cattail.
(7) Bael Fruit.
(8) Water Chestnut (Trapa Nut).
(9) Bamboo.
(10) Chufa (Nut Grass).
(11) Goa Bean.
(12) Luffa Sponge (Wild Gourd).
(13) Yam Bean.
(14) Wild Fig.
(15) Bignay.
(16) Wild Grape.
(17) Lotus Lilly.
(18) Water Lettuce.
(19) Breadfruit.
(20) Canna Lily.
(21) Bracken (Fern).
(22) Sego Palm.
(23) Tree Fern.
(24) Palm Sugar.
(25) Mango.
(26) Papaya.
(27) Italian Millet.
(28) Screw Pine.
(29) Pearl Millet.
(30) Plantain.
(31) Mulberry.
(32) Batolo Plum.

Figure 11-5. Rain Forest (New Zealand).

(33) Cashew Nut.
(34) Pokeweed.
(35) Buri Palm.
(36) Polypody.
(37) Fishtail Palm.
(38) Air Potato (ubi tuber).
(39) Coconut Palm.
(40) Purslane.
(41) Nipa Palm.
(42) Rice.
(43) Rattan Palm.
(44) Soursop.
(45) Ceylon Spinach.
(46) Water Lilly.
(47) Sterculia.
(48) Sweetsop.
(49) Tamarind.
(50) Taro.
(51) Ti Plant.
(52) Horseradish Tree.
(53) Tropical Yam.

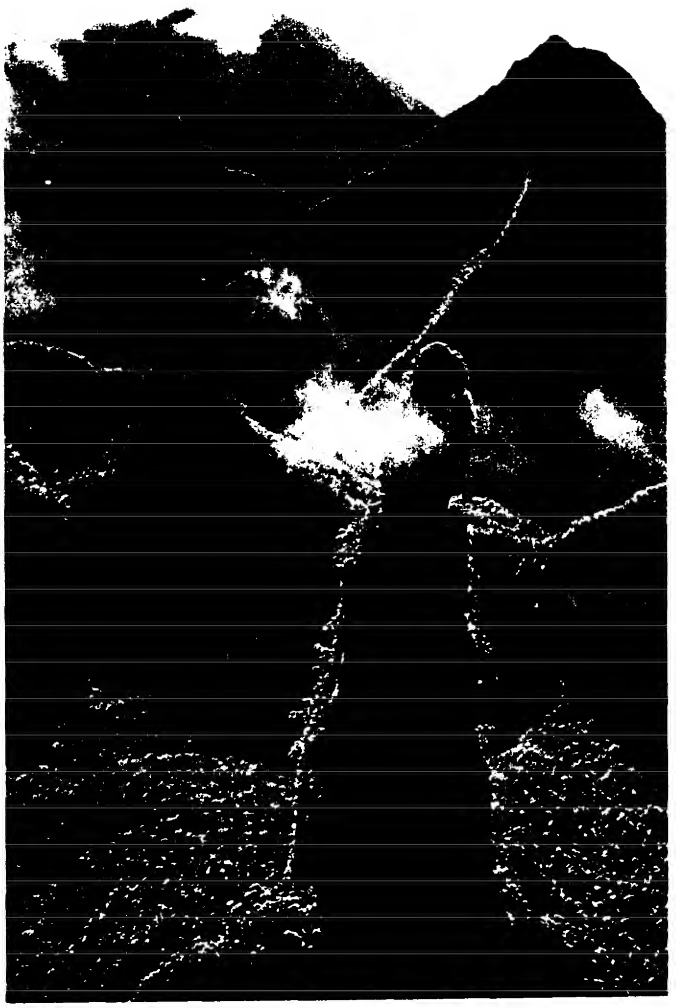


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Figure 11-6. Rain Forest (Tahiti).

e. Semi-Evergreen Seasonal Forest:

(1) In character, the semi-evergreen seasonal forest in Central and South America and Africa corresponds essentially to the monsoon forest of Asia. Characteristics of the semi-evergreen forest are:

(a) Two stories of tree strata—upper story 60 to 80 feet high; lower story 20 to 45 feet high.

(b) Large trees are rare; average diameter about 2 feet.

(c) Seasonal drought causes leaf fall; more in dry years.

(2) The peculiar distribution of the rainy season and the dry season which occurs in the countries bordering the Bay of Bengal in southeastern Asia brings on the monsoon climate. The monsoons of India, Burma, and Southeast Asia are of two types. The dry monsoon occurs from November to April, when the dry northern winds from central Asia bring long periods of clear weather with only intermittent rain. The wet monsoon occurs from May to October, when the southern winds from the Bay of Bengal bring rain, usually in torrents, that lasts for days and often weeks at a time. During the dry season, most leaves drop completely off, giving the landscape a wintry appearance, but as soon as the monsoon rains begin, the foliage reappears immediately.

f. Plant Foods of the Semi-Evergreen Seasonal Forest. These foods include:

(1) Agave (Century Plant).
(2) Amaranth.
(3) Bael Fruit.
(4) Banana.
(5) Tropical or Indian Almond.
(6) Rose Apple.
(7) Bamboo.
(8) Goa Bean.
(9) Yam Bean.
(10) Mango.
(11) Purslane.
(12) Mulberry.
(13) Bignay.
(14) Italian Millet.
(15) Soursop.
(16) Cashew Nut.
(17) Breadfruit.
(18) Pearl Millet.
(19) Ceylon Spinach.
(20) Sterculia.
(21) Sugar Cane.
(22) English Acorns (Oak).
(23) Luffa Sponge (Wild Gourd).
(24) Cattail.
(25) Buri Palm.
(26) Sweetsop.
(27) Chestnut.
(28) Water Chestnut (Trapa Nut).
(29) Rattan Palm.
(30) Tamarind.
(31) Chufa (Nut Grass).
(32) Papaya.
(33) Taro.
(34) Ti Plant.
(35) Wild Fig.
(36) Screw Pine.
(37) Horseradish Tree.
(38) Tree Fern.
(39) Plaintain.
(40) Tropical Yam.
(41) Wild Grape.
(42) Pokeweed.
(43) Water Lettuce.
(44) Polypody.
(45) Canna Lily.
(46) Air Potato (ubi tuber).
(47) Lilly Lotus.
(48) Water Lily.

g. Tropical Scrub and Thorn Forest (figure 11-7):

(1) Chief Characteristics of the Tropical Scrub and Thorn Forest:

(a) Definite dry season, with wet season varying in length from year to year. Rains appear mainly as downpours from thunderstorms.

(b) Trees are leafless during dry season; average height is 20 to 30 feet with tangled undergrowth in places (figure 11-8).

(c) Ground is bare except for a few tufted plants in bunches; grasses are not common.

(d) Plants with thorns are predominate.

(e) Fires occur at intervals.

(2) Food Plants:

(a) Within the tropical scrub and thorn forest areas, the survivor will find it difficult to get food plants in the dry season. During the height of the drought period, the primary kinds of foods come from the following plant parts:

-1. Tubers.
-2. Bulbs.
-3. Pitch.
-4. Nuts.
-5. Rootstalks.
-6. Corms.
-7. Gums and Resins.
-8. Seeds and Grains.

(b) During the rainy season in the tropical scrub and thorn forest, plant food is considerably more abundant. At this time, the survivor should look for the following edible plants:

-1.Sweet Acacia.
-2.Wild Chicory.
-3.St. John's Bread.
-4.Wild Caper.
-5.Agave (Century Plant).
-6.Wild Fig.
-7.Almond.
-8.Cashew Nut.
-9.Baobab.
-10.Juniper.
-11.Tamarind.
-12.Tropical Yam.
-13.Sea Orach.
-14.Prickly Pear.
-15.Wild Pistachio.
-16.Air Potato (ubi tuber).

h. Tropical Savanna. (See figure 11-9.)

(1) General Characteristics of the Savanna:

(a) Savannas lie wholly within the tropical zone in South America and Africa.

(b) The savanna looks like a broad, grassy meadow with trees spaced at wide intervals.

(c) The grasses of the tropical savanna often exceed the height of a man. However, none of the savanna grasses are sod-forming in the manner of lawn grasses, but are bunch grasses with a definite space between each grass plant.

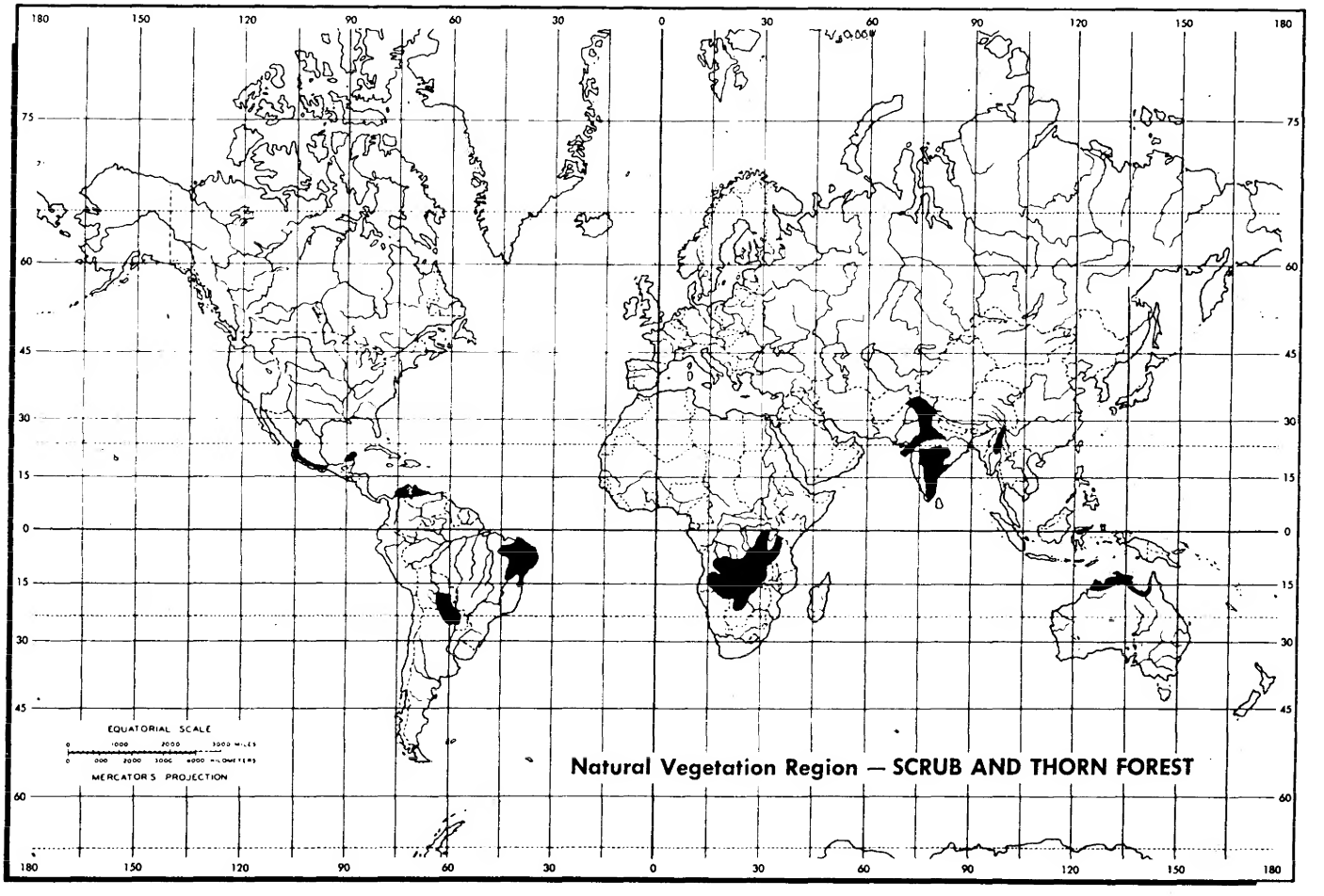

Figure 11-7. Shrub and Thorn Forest.

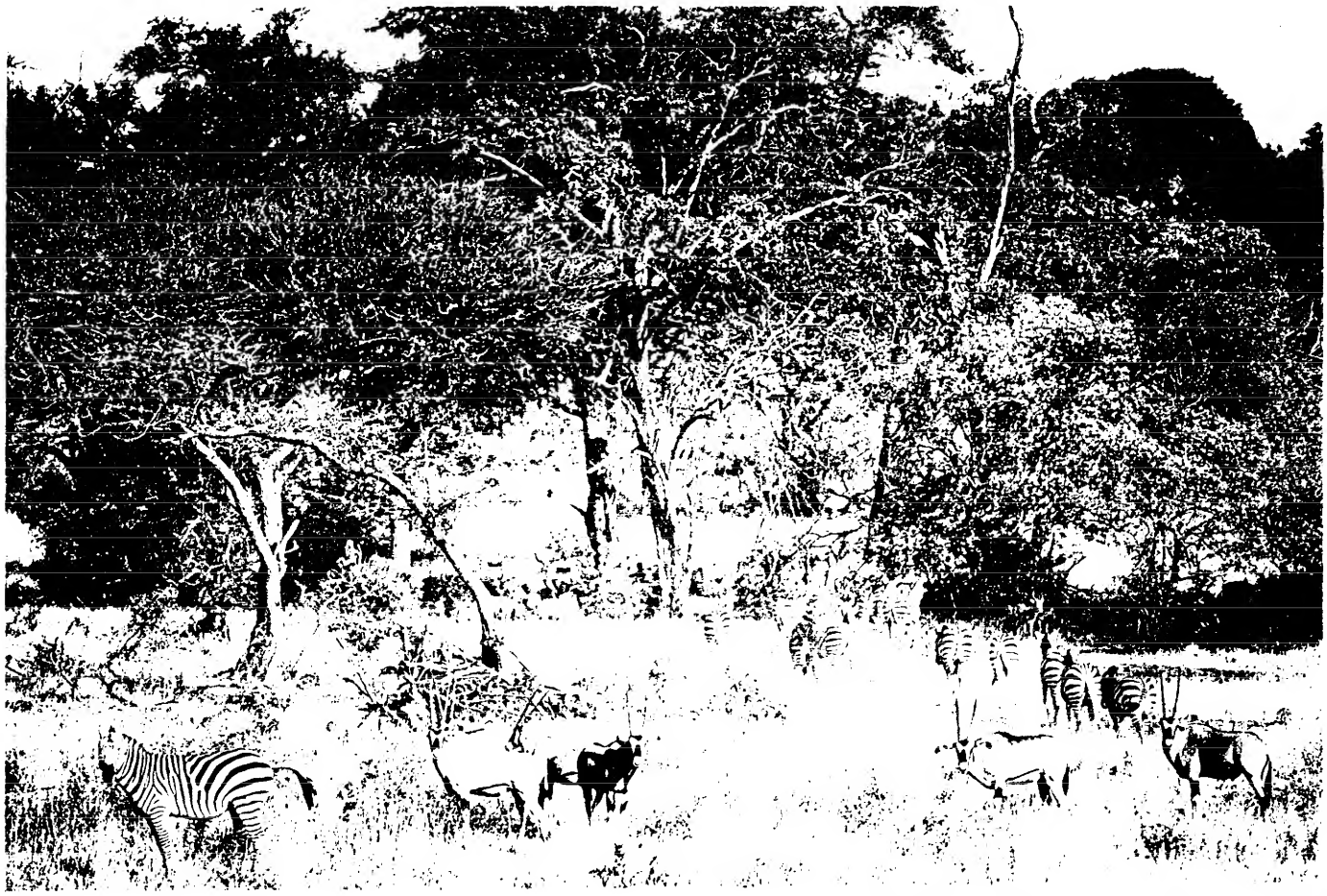

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Figure 11-8. Tropical Shrub or Thorn Forest (Kenya).

(d) The soil in the savanna is frequently red.

(e) The scattered trees usually appear stunted and gnarled like old apple

(f) Palms may be found on savannas.

(2) Savanna of South America. For the most part, the vegetation is of the bunch-grass type. A long, dry season alternates with a rainy season. In these areas, both high and low grasses are present. Bright colored flowers appear between the grass bunches during the rainy season. The grains from the numerous grasses are useful as survival food, as well as the underground parts of the many seasonal plants that appear with and following the rains.

(3) Savanna in Africa. The high grass tropical savanna of Africa is dominated by very tall, coarse grasses which grow from 5 to 15 feet high. Unless the natives burn the grass during the dry season, the savanna becomes almost impenetrable. This type of savanna occurs in a broad belt surrounding the tropical rain forest and extends from western Africa eastward beyond the Nile River. From the Nile, it extends southward and westward. The tropical bunch grass savanna comprises the greatest part of the African savanna consisting of grasses about 3 feet tall. The African savanna has both dwarf and large trees. The most renowned of these large trees is the monkeybread or baobab (figure 11-10).

(4) Food Plants. The food plants found on the savanna are also found in other vegetation areas.

(a) Amaranth.
(b) Wild Crabapple.
(c) Purslane.
(d) Wild Apple.
(e) Wild Dock.
(f) Wild Sorrel.
(g) Wild Chicory.
(h) Wild Fig.
(i) Tamarind.
(j) Chufa (Nut Grass).
(k) Water Plaintain.
(l) Water Lily.

i. Animal Life. The tropics abound in animal life. The tremendous varieties of animal species found in tropical areas throughout the world preclude discussions of each animal. It is essential that the survivor realize that just as people have an inherent fear of some animals, most animals also fear people. With some exceptions, animals of the tropics will withdraw from any encounter with humans. Being primarily nocturnal animals, most

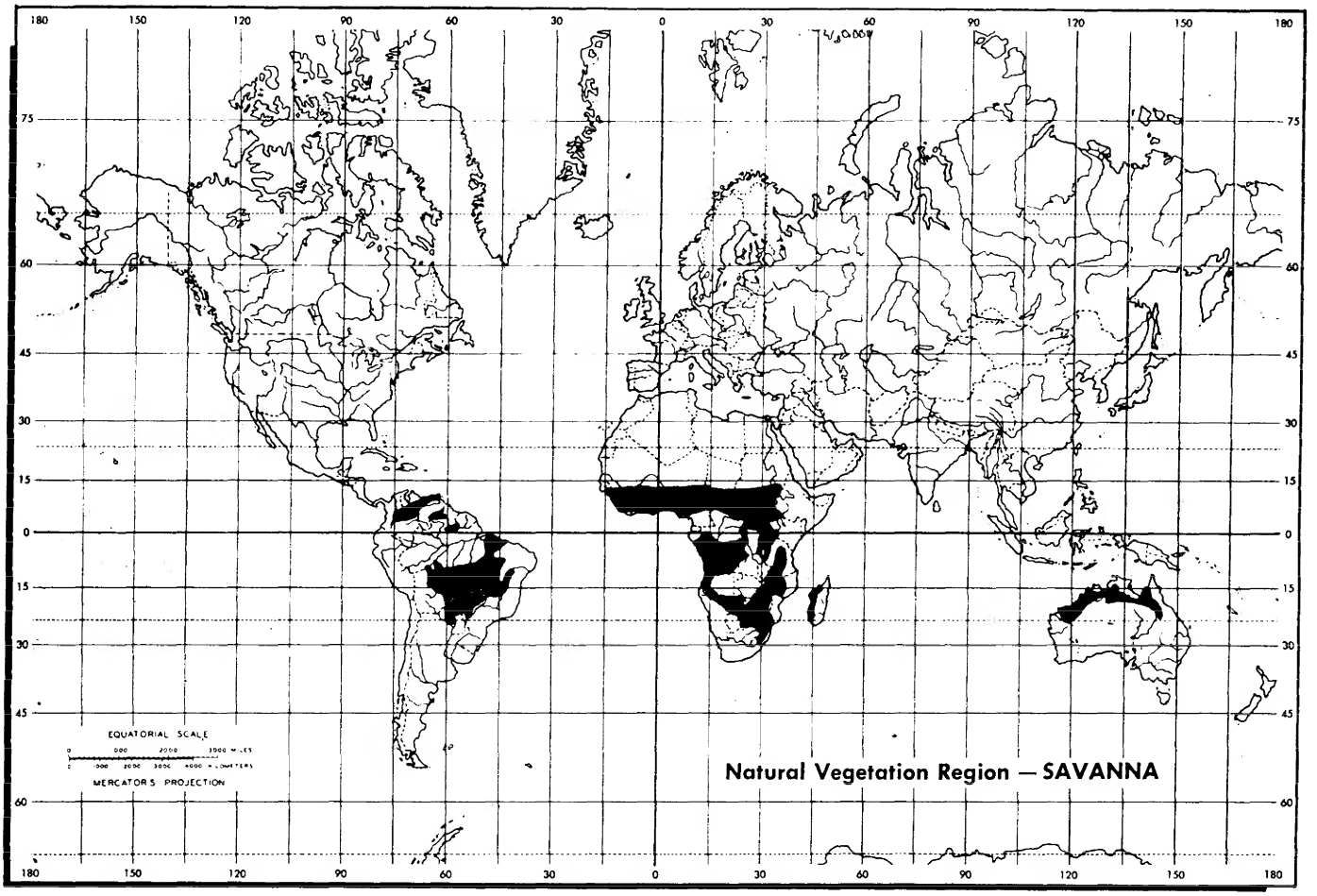

Figure 11-9. Savanna.

will never be seen by the survivor. By becoming familiar with the wild inhabitants of the tropics, the survivor will better understand this type of environment and will respect, not fear, the surroundings in which survival takes place.

(1) All tropic areas have members of the pig family. By habit, pigs are gregarious and are omnivorous in diet. They will eat any small animals they can kill, although they feed mainly on roots, tubers, and other vegetable substances. The most common species found in the Old World tropics are the peccary, the Indian wild boar, the Babirussa of Celebes, and the Central African Giant Forest Hog. In Central and South American tropics, peccaries are common. These pigs are represented by two species, the "white-lipped" peccary and the "collared" peccary. Both are grizzled black color, distinguishable by markings from which they derive their names. The white-lipped peccary, the larger of the two (height of approximately 18 inches), is black with white under the snout, and has the reputation of being the more ferocious. The collared peccary, reaching a height of 14 inches, is identified by the white or gray band around the body where the neck joins the shoulder. The collared peccary often travels in groups of 5 to 15. While alone, they are not particularly dangerous, but a pack can effectively repel any enemy and can make short work of a jaguar, cougar, or human. Both types of peccaries have musk glands which are located 4 inches up from the tail on the spine. This gland must be removed soon after the animal is killed, otherwise the flesh will become tainted and unfit for consumption.

(2) Tropic areas harbor many species of reptiles and amphibians. Most of them are edible when skinned and cooked. Hazards from these animals are mostly imagined; however, some are venomous or dangerous if encountered. Individual species of crocodylidae family (alligators, crocodiles, caiman, and gavials) are usually only abundant in remote areas away from humans. Most dangerous are the saltwater crocodiles of the Far East and the Nile crocodiles in Africa. Poisonous snakes, while numerous in the tropics, are rarely seen and pose little danger to the wary survivor. There are no known poisonous lizards in the tropics. Several species of frogs and toads contain poisonous skin secretions.

PLAINS OF TANGANYIKA

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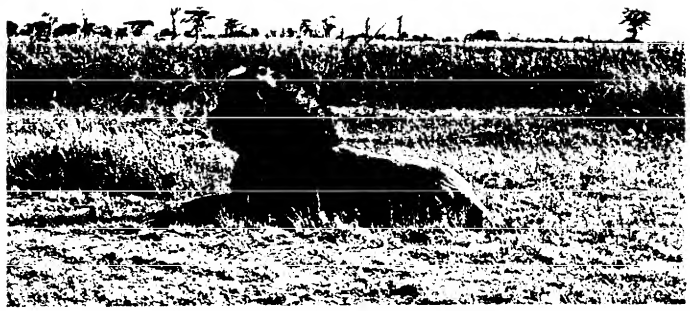
KENYA



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NAIROBI, KENYA

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IHOSY, MADAGASCAR

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Figure 11-10. Savanna (Ihosy, Madagascar; Plains of Tanganyika; Kenya; and Nairobi, Kenya).

The large, pan-tropic toad, Bufo Marimum, exudes a particularly irritating secretion if handled roughly. Aside from skin irritations, these amphibians pose little danger to humans, unless the secretion gets into the eyes, where it may cause blurred vision, intense burning, and possible blindness.

(3) All tropical areas of the world abound in monkeys. They are very curious animals and this fact may be used to the survivor's advantage in trying to procure one for food. Only the very large species of monkey, such as the mandrill or baboon, could constitute any danger to humans.

(4) Tropic areas also have a large number of the various species of mice, rats, squirrels, and rabbits.

(5) Members of the cat family are found in jungles throughout the world. The ocelot abounds in the jungles of Central and South America. It is a small, lean, savage cat whose coloring closely resembles that of the jaguar and will attain a weight of approximately 40 pounds and a length of 3 feet when fully grown. Cats such as the leopard are found in the tropics of the old world. The leopard is one of the most wary of beasts, becoming a powerful fighter when wounded or cornered. Unlike lions and tigers, the leopard can climb trees with ease; therefore, caution should be used when hunting this animal.

(6) Deer are found in most jungle areas; however, their population is normally small. In the Asian jungles,

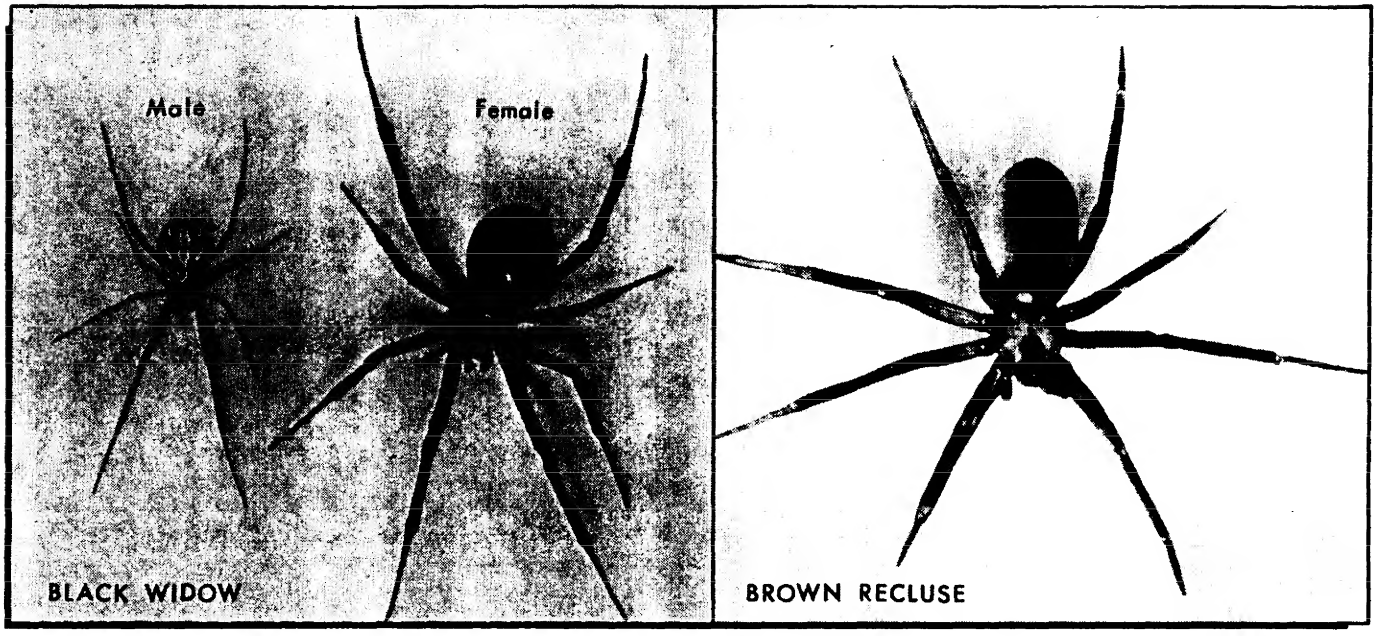


Figure 11-11. Black Widow and Brown Recluse Spiders.

several species of deer frequent the low, marshy areas adjacent to rivers. In the Central and South American jungles, two species of deer are most common. The jungle species is found in thick upland forests. It is much smaller than the North American species and seldom attains a weight of more than 80 pounds. Another deer found in the Central and South American jungles is the "brocket" or "jungle deer." This small reddish-brown deer, which attains a height of about 23 inches, is extremely shy and is found mostly in dense cover since it has no defense against other animals.

(7) The real dangers lie in the insects located in the jungle, which can pass on diseases or parasites.

(a) Malaria may be the worst enemy. It is transmitted by mosquitoes, which are normally encountered from late afternoon until early morning. Guard against bites by camping away from swamps on high land and sleep under mosquito netting, if available; otherwise, use mud on the face as a protection against insects. Wear full clothing, especially at night, and tuck pants into the tops of socks or shoes. Wear mosquito head net and gloves. Take antimalaria tablets (if available) according to directions.

(b) The greatest number of ant species is found in the jungle regions of the world. Nesting sites may be in the ground or in the trees. Ants can be a considerable nuisance especially if near a campsite. They inflict pain by biting, stinging, or squirting a spray of formic acid. Before selecting a campsite, a close check of the area should be made for any nests or trails of ants.

(c) Ticks may be numerous, especially in grassy places. Use a protected area and undress often, inspecting all parts of the body for ticks, leeches, bed bugs, and other pests. If there are several people in the group, examine each other.

(d) Fleas are common in dry, dusty buildings. The females will burrow under the toenails or into the skin to lay their eggs. Remove them as soon as possible. In India and southern China, bubonic plague is a constant threat. Rat fleas carry this disease and discovery of dead rats usually means a plague epidemic in the rat population. Fleas may also transmit typhus fever and in many parts of the tropics, rats also carry parasites which cause jaundice and other fevers. Keep food in rat-proof containers or in rodent-proof caches. Do not sleep with any food in the shelter!

(e) In many parts of the Far East, a type of typhus fever is carried by tiny red mites. These mites resemble the chiggers of southern and southwestern United States. They live in the soil and are common in tall grass, cut-over jungle, or stream banks. When a person lies or sits on the ground, the mites emerge from the soil, crawl through clothes, and bite. Usually people don't know they have been bitten, as the bite is painless and does not itch. Mite typhus is a serious disease and the survivor should take preventive measures to avoid this pest. The survivor should clear the camping ground and burn it off, sleep above the ground, and treat clothing with insect repellant.

(f) Leeches are primarily aquatic and their dependence on moisture largely determines their distribution. The aquatic leeches are normally found in still, freshwater lakes, ponds, and waterholes. They are attracted by disturbances in the water and by a chemical sense.

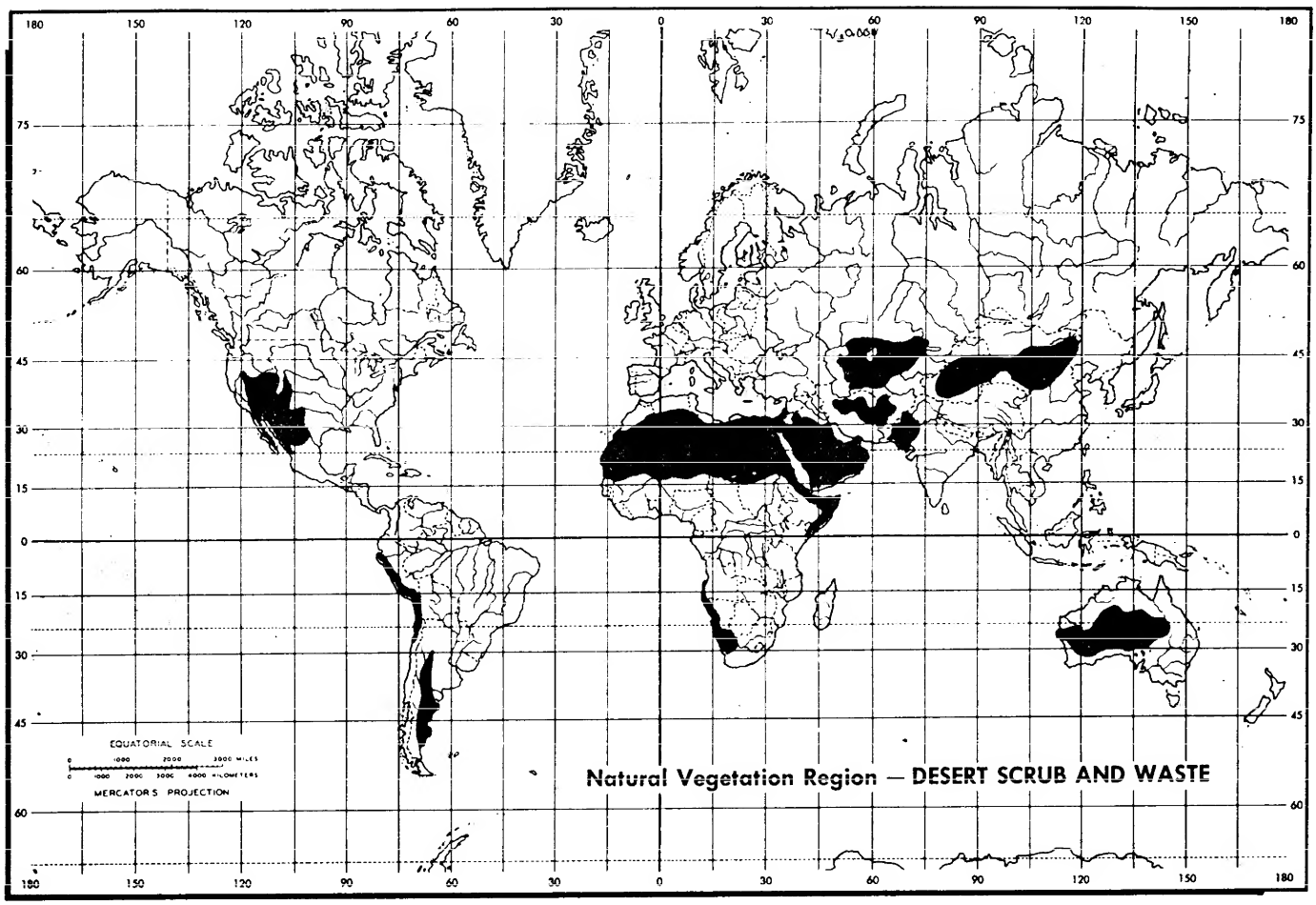


Figure 11-12. Desert Scrub and Waste Areas.

Land leeches are quite bloodthirsty and easily aroused by a combination of odor, light, temperature, and mechanical sense. These leeches are the most feared of all since they may enter air passages from which they cannot escape once they have fed and become distended. Normally, there is little pain when leeches attach themselves, and after they fill with blood, they drop off unnoticed. Some leeches, living in springs and wells, may enter the mouth or nostrils when drinking and may cause bleeding and obstruction.

(g) Spiders, scorpions, hairy caterpillers, and centipedes are often abundant. The survivor should shake out shoes, socks, and clothing and inspect bedding morning and evening. A few spiders have poisonous bites which may cause severe pain. The black widow and the brown recluse spiders are venomous and should be considered very dangerous (figure 11-11). The large spiders called tarantulas rarely bite, but if touched, the short, hard hairs which cover them may come off and irritate the skin. Centipedes bite if touched and their bite is like that of a wasp's sting. Avoid all types of many-legged insects. Scorpions are real pests as they like to hide in clothing, bedding, or shoes and strike without being touched. Their sting can cause illness or death.

j. Population. Density of human population varies with the climate. Cultivation is difficult in areas of tropical rain forests along the Equator. The torrential rains leach out the soil and weeds grow rapidly. Consequently, cultivated food sources must be supplemented by game and other products of the forest. Villages are usually scattered along rivers since movement is easier by water than through the dense forest. Numerous people are also located along coastal areas where farming takes place and people can obtain food from the sea.

11-4. Dry Climates. Dry climates are generally thought of as hot, barren areas that receive scanty rainfall. Rainfall is limited but dry climates are not barren wastelands and many kinds of plants and animals thrive (figure 11-12).

a. Deserts:

(1) Most deserts are located between the latitudes of 15 and 35 degrees on each side of the Equator and are

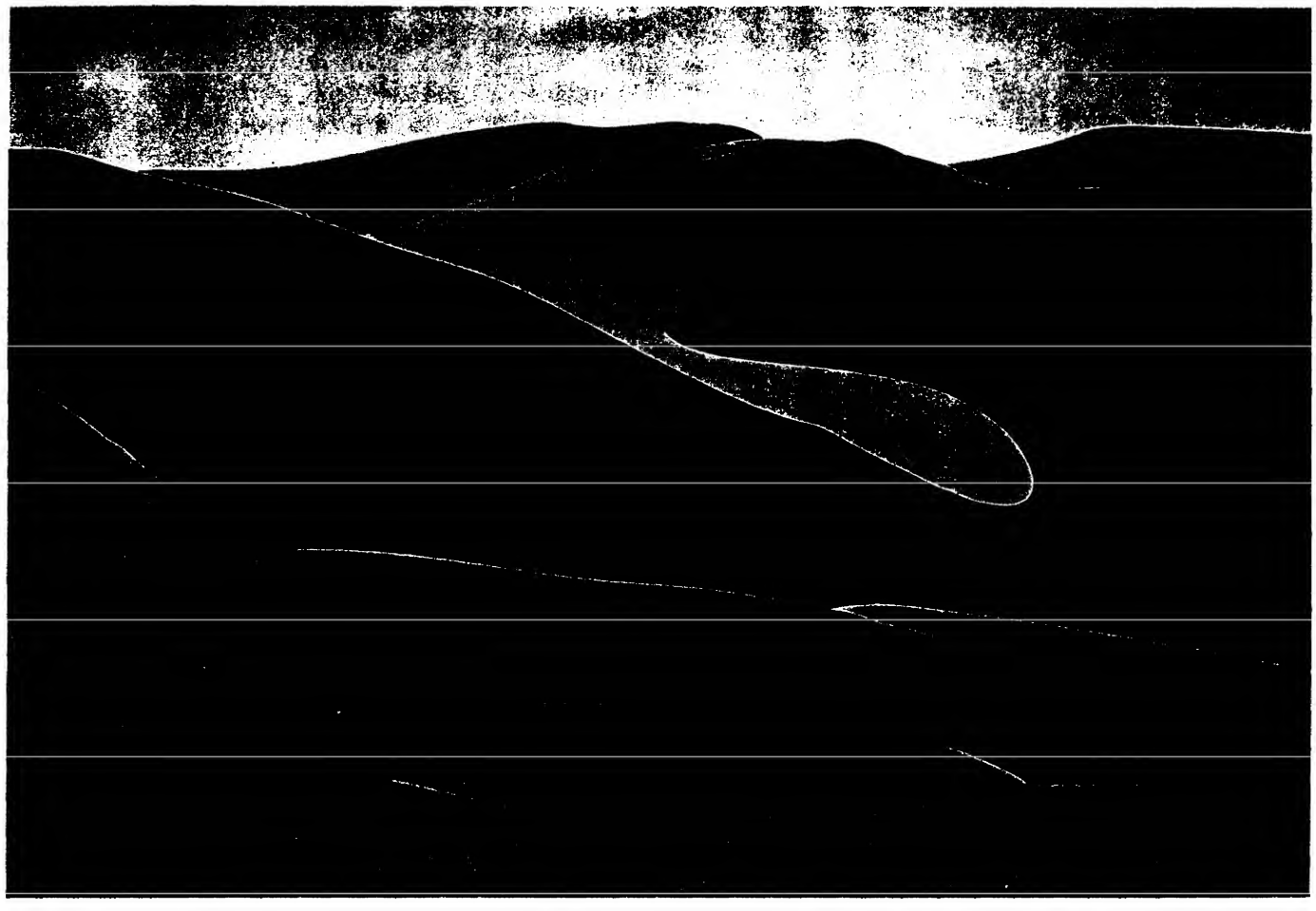


Figure 11-13. The Sahara.

dry regions where the annual evaporation rate exceeds the annual precipitation rate (generally less than 10 inches of rain annually). Extremes of temperature are as characteristic of deserts as is lack of rain and great distances. Hot days and cool nights are usual. A daily low-high of 45°F in the Sahara Desert and a 25°F to 35°F difference in the Gobi Desert is the rule. The difference between summer and winter temperatures is also extreme.

(2) Deserts occupy nearly 20 percent of the Earth's land surface, but only about 4 percent of the world's population lives there. The term "desert" is applied to a variety of areas. There are alkali deserts, rock deserts, and sand deserts. Some are barren gravel plains without a spear of grass, a bush, or cactus for a hundred miles. In other deserts, there are grasses and thorny bushes where camels, goats, or even sheep find a subsistent diet. Anywhere they are found, deserts are places of extremes. They can be extremely dry, hot, cold, and often devoid of plants, trees, lakes, or rivers. Most important to the survivor is the extremely long time (distance) between water sources. The vast deserts of North Africa, Arabia, Iran, West Pakistan, the Mojave Desert of the southwestern United States and northern Mexico, the interior Kalahari Desert of South Africa, and the Australian Desert are major examples of this type.

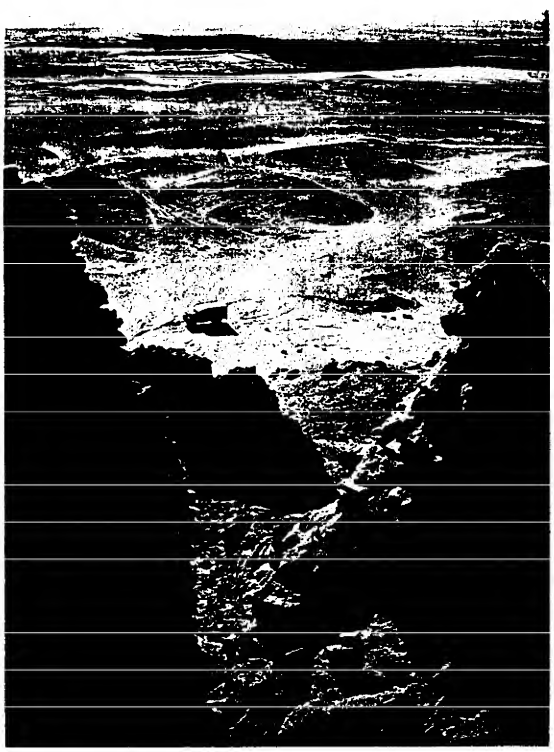
(3) Desert areas and climatic characteristics and seasonal variations of world deserts are as follows:

(a) Sahara Desert. The Sahara is the largest desert in the world. It stretches across North Africa from the Atlantic Ocean to the Red Sea and from the Mediterranean and the Sahara Atlas Mountains in the north to the Niger River in tropical Africa. It consists of 3 million square miles of level plains and jagged mountains, rocky plateaus, and graceful sand dunes. There are thousands of square miles where there is not a spear of grass, not a bush or tree, nor a sign of any vegetation. But Sahara oases—low spots in the desert where water can be reached for irrigation—are among the most densely populated areas in the world. Date groves and garden patches supporting 1,000 people per square mile are surrounded by barren plains devoid of life. Only 10

percent of the Sahara is sandy. The greater part of the desert is flat gravel plain from which the sand has been blown away and accumulated in limited areas forming dunes. There are rocky mountains rising 11,000 feet above sea level and there are a few depressions 50 to 100 feet below sea level. The change from plain to mountain is abrupt in the Sahara. Mountains generally go straight up from the plain like jagged skyscrapers from a city street. Sharp rising mountains on a level plain are especially noticeable in many desert landscapes because there is no vegetation to modify that abruptness. The lack of trees or bushes makes even occasional foothills appear more abrupt than in temperate climates (figure 11-13).

(b) Arabian Desert. Some geographers consider the Arabian Desert as a continuation of the Sahara. Half a million square miles in area, the Arabian Desert covers most of the Arabian Peninsula except for fertile fringes along the Mediterranean Sea, Red Sea, Arabian Sea, and the valleys of the Tigris-Euphrates Rivers. Along much of the Arabian coastline, the desert meets the sea. There is more sand in the Arabian Desert than in the Sahara and there are fewer date grove oases. These are on the east side of the desert at Gatif, Hofuf, and Medina. Also, there is some rain in Arabia each year, in contrast to the decades in the Sahara that pass without a drop. Arabia has more widespread vegetation, but nomads find scanty pasture for their flocks of sheep and goats and must depend on wells for water. Oil is carried across the desert in pipelines which are regularly patrolled by aircraft. Pumping stations are located at intervals. All these evidences of modern civilization have increased the well-being of the desert people and, as a result, chances for a safe journey afoot. However, the desert of Arabia is rugged, and native Arabs still get lost and die from dehydration.

(c) Gobi Desert - "Waterless Place." As used here, "Gobi" means only the 125,000 square mile basin or saucer-like plateau north of China which includes Inner and Outer Mongolia. On all sides of the Gobi, mountains form the rim of the basin. The basin itself slopes so gently that much of it appears to be a level plain. The Gobi has rocks, buttes, and numerous badlands, or deeply gullied areas (figure 11-14). For a hundred miles or so around the rim of the Gobi, there is a band of grassland. In average years, the Chinese find this to be a productive farmland. In drought years, agriculture retreats. Moving toward the center of the Gobi, there is less and less rainfall; soil becomes thinner, and grass grows in scattered bunches. This is the home of the Mongol herdsman. His wealth is chiefly horses, but he also raises sheep, goats, camels, and a few cattle. Beyond the rich grassland, the Gobi floor is a mosiac of tiny pebbles which often glisten in sunlight. These pebbles were once mixed with the sand and soil of the area, but in the course of centuries, the soil has been washed or blown away and the pebbles have been left behind as loose pavement. What rain there is in the Gobi drains



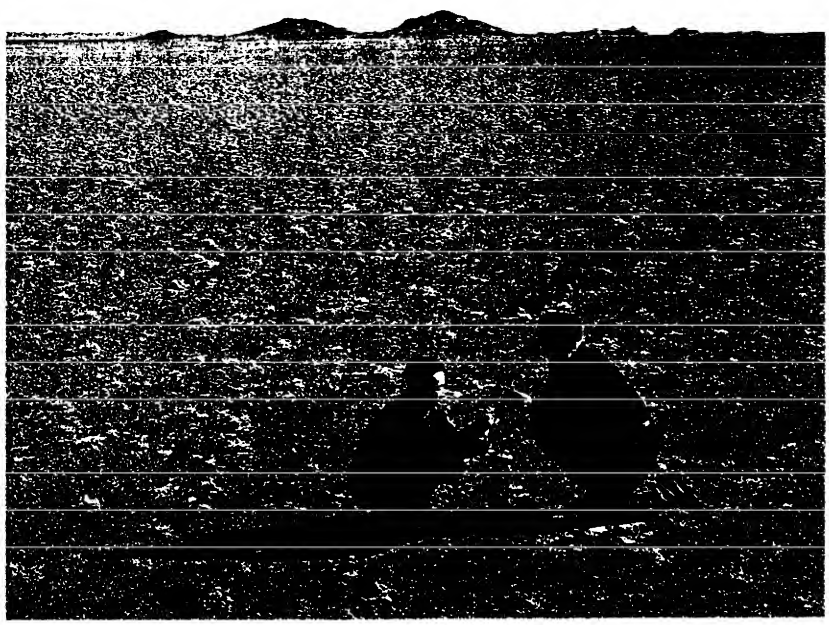


Figure 11-14. The Gobi.

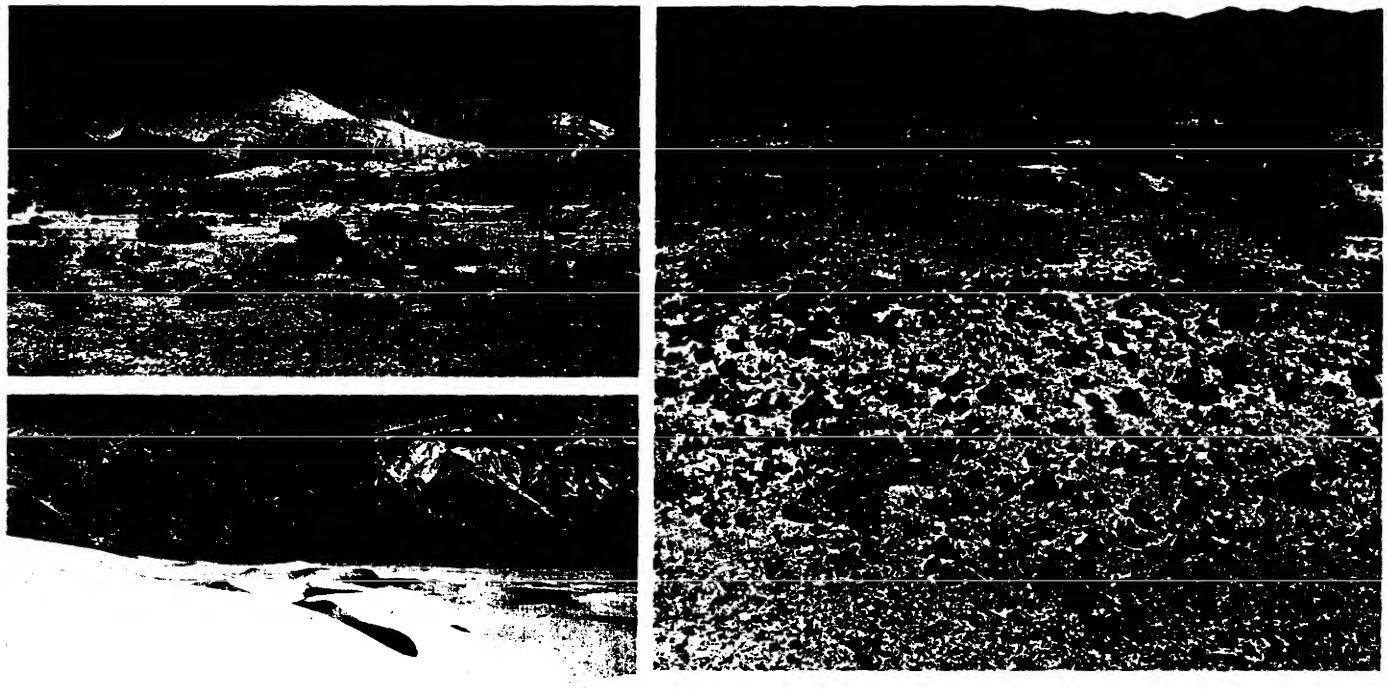


Figure 11-15. Composite of American Deserts.

toward the basin; almost none of it cuts through the mountain rim to the ocean. There are some distinct and well-channeled watercourses, but these are usually dry. Many are remnants of prehistoric drainage systems. In the east, numerous shallow salt lakes are scattered over the plain. They vary in size and number with the changes of rainfall in the area. Sand dunes are found in the eastern and western Gobi, but these features are not as pronounced as they are in certain sections of the Sahara Desert. The Gobi is not a starkly barren wasteland like the great African Desert. Grass grows everywhere, although it is often scanty. Mongols live in collective type farm systems and habitations instead of being concentrated in oases (figure 11-14).

(d) Australian Desert. More than one-third of Australia's total area is desert. Rainfall in the area is unpredictable with an average of less than 10 inches per year. There are three connecting deserts which occupy western Australia and one desert located in the center of the continent. They are the Great Sandy Desert, Great Victorian Desert, Gibson Desert, and Simpon or Arunta Desert. The three largest deserts, Sandy, Victoria, and Arunta are of the sandy type, held in place by vegetation. The Gibson in the western portion, is a stone-type desert. Most of the deserts of Australia have elevations of 1,000 to 2,000 feet.

(e) Atacama-Peruvian Desert of South America. Generally, there are two regions of desert in South America. The first, and by far the largest, is along the west coast, beginning in the southern part of Ecuador, extending the entire coastline of Peru, and reaching nearly as far south as Valparaiso in Chile. This region, of about 2,000 miles in length and approximately 100 miles in width, is classified as true desert. Even so, along the shoreline of Peru as far south as Africa and inland a few miles, there is often a low-cloud or misty-fog layer. The layer is approximately 1,000 feet thick and produces a fine drizzle. Because of this frequent cloud cover and other phenomena, the temperature along the coastal desert is remarkably cool, averaging about 72°F in the summer daytime and about 55°F in the winter daytime. From about 30 degrees south, the cloud cover does not exist and this region may truly be called rainless. The rare and uncertain showers are valueless for cultivated vegetation. Behind the coastal ranges in the higher elevations, the dryness is at a maximum. In the nitrate fields of the Great Atcama Desert, the air is very dry and the slightest shower is very rare. Here the summer daytime temperatures are from 85°F to 90°F. The second desert region is entirely in Argentina (east of the Andes) extending in a finger-like strip from about 30 degrees south, southwest to about 50 degrees south. This region is approximately 1,200 miles long and 100

miles wide. In this highly dissected plateau region, the temperature ranges from a yearly average of 63°F in the north to 47°F in the south. The average annual rainfall pattern is from about 4 inches in the north to about 6 inches in the south.

(f) Southwest Deserts of the United States and Mexico:

-1. These desert areas have four major subdivisions:

-a. Great Basin—the basin between the Rocky Mountains and the Sierra Nevada-Cascade Ranges of southern Nevada and western Utah.

-b. Mojave Desert— Southwestern California.

-c. Sonoran Desert—Southeastern California across southern Arizona into the southwest corner of New Mexico and from Sonora and Baja, California, into Mexico.

-d. Chihuahuan Desert—Lies to the east of the Great Sierra Madre Occidental, spreading north into southwest Texas, southern New Mexico, and southeast corner of Arizona (figure 11-15).

-2. The flat plains with scanty vegetation and abruptly rising buttes of our Southwest are reminders of both the Gobi and Sahara. But the spectacular rock-walled canyons found in the Southwest have few counterparts in the deserts of Africa and Asia. The gullied badlands of the Gobi resemble similar formations in both the Southwest and the Dakotas, but our desert rivers—the lower Colorado, lower Rio Grande, and tributaries such as the Gila and the Pecos—have a more regular supply of water than is found in Old World deserts. The Nile and Niger are, in part, desert rivers but get their water from tropical Africa. They are desert immigrant rivers (like the Colorado, which collects the melting snows of the southern Rockies) and gain sufficient volume to carry them through the desert country. In general, the southwest deserts have more varied vegetation, greater variety of scenery, and more rugged landscape than either the Gobi or the Sahara. In all three areas, it is often a long time (distance) between water sources. Death Valley, a part of the Mojave lying in southern California, probably has more waterholes and more vegetation than exist in vast stretches of the Sahara. The evil reputation of the Valley appears to have been started by unwise travelers who were too terrified to make intelligent searches for food and water. The dryness of the Death Valley atmosphere is unquestioned, but it lacks the vast barren plains stretching from horizon to horizon in the Sahara. Compared to the Sahara, the desert country of southwestern United States and Mexico sometimes looks like a luxuriant garden. There are many kinds of cactus plants in the desert, but these are not found in either the Sahara or Gobi.

(g) Kalahari Desert. This desert is located in the southern part of Africa. The wasteland covers about 200,000 square miles and lies about 3,000 feet above sea level. Some parts are largely covered with grassland and scrubby trees. The climate is similar to that of the Atacama-Peruvian Desert of South America.

b. Vegetation. The following are the more common xerophytic plants (those plants that can live with a limited water supply) which are found in the major deserts of the world.

(1) Cactus Family (Cactaceae). Most cactus fruits and leaves have spines to protect them from birds and

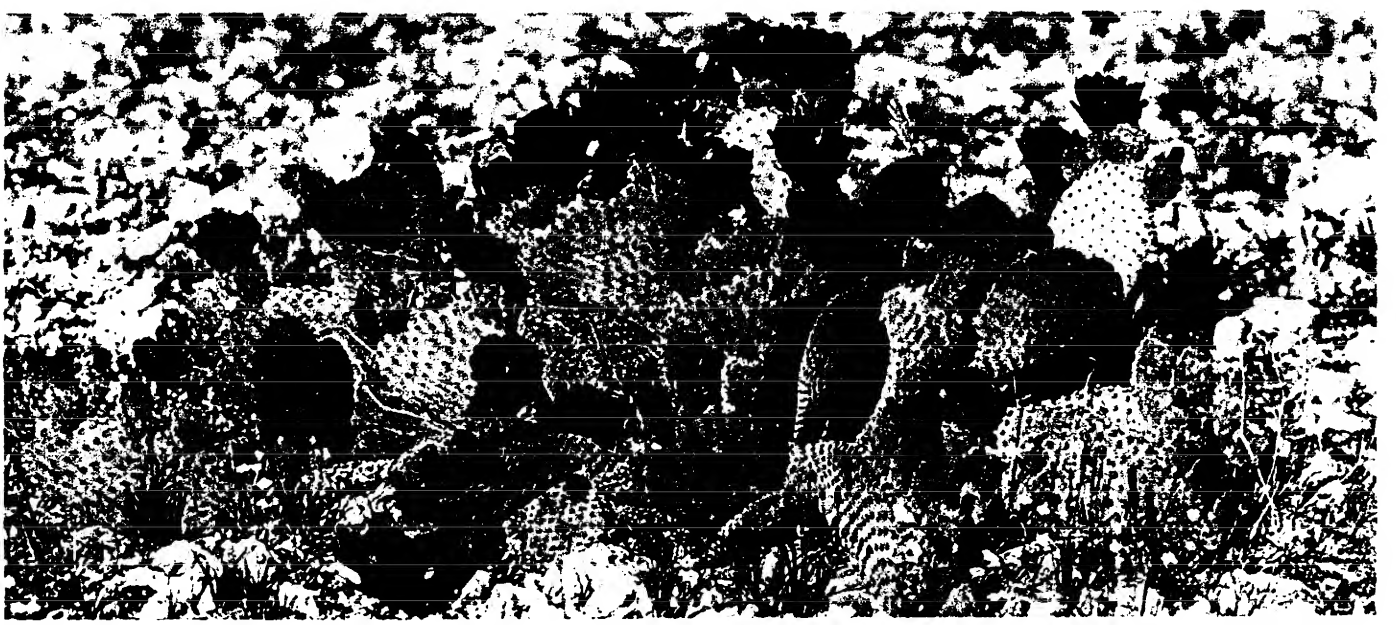


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Figure 11-16. Prickly Pear.

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Figure 11-17. Barrel Cactus.

animals seeking water stored in the stems and leaves. Flat cactus leaves can be boiled and eaten and the flowering fruit is edible.

(a) Prickly Pear. Is native and most abundant in the American deserts, but has been introduced into the Gobi, Sahara, and Australian Deserts, and other parts of the world (figure 11-16).

(b) Barrel Cactus. Found in many places, but is only native to the North American deserts. It grows to 5 or 6 feet high (figure 11-17).

(c) Suguaro (Giant) Cactus. Abundant in southern Arizona and in Sonora, Mexico. Can grow up to 50 feet tall.

(2) Wild Onion. Found in the Great Basin of the Southwest and in the Gobi Desert. The bulbs are edible if they look, smell, and taste like an onion or garlic.

(3) Wild Tulip. Found in the Gobi and Sahara Deserts. The bulbs can be eaten.

(4) Shrubs:

(a) Abal. Grows to about 4 feet tall in sandy deserts. The fresh flowers can be eaten. The dry twigs can be crushed and used as a tea substitute. It is found in the Sahara and Arabian Deserts.

(b) Acacia. Most common in the Sahara, Gobi, and Australian desert regions, and in the warmer and drier parts of America. The beans can be crushed and cooked as porridge. It is spiny with many branches and grows to 10 feet tall; roots yield water 4 to 5 feet from the tree trunk (figure 11-18).

(c) Saxaul. Found on the salt deserts of the Gobi Desert. The bark acts as water storage and is a good water source.

(d) St John's Bread. Found along the border of the Mediterranean coast of the Sahara and across the Arabian Desert. Grows 40 to 50 feet tall and seeds can be pulverized and cooked as a porridge (most nutritious plant food in the Middle East).

(e) Juniper. Found in the mountainous areas of the American deserts.

(f) Vines. Wild desert gourds are found in the Sahara and Arabian Deserts. They have a vine which grows from 8 to 30 feet long, and produce a melon-like poisonous fruit. The seed can be eaten when roasted or boiled. Flowers are also edible (figure 11-19).

(g) Succulent Plants. They are filled with juices and store moisture to survive. The surface is covered with a layer of wax or a blanket of fine hairs for protection against the heat. The moisture is contained in a tough cellulos that is not digestible and must be manually broken down to release the water.

(h) Creosote Bush. This is the most widespread and successful plant of the American deserts (height from 2 to 10 feet).

(5) Dates. Occur in groves around desert oases of the lower areas of the Sahara Desert.

c. Animal Life. There are over 5,000 species of birds, reptiles, mammals, and insects found in desert areas. The raven, dove, woodpecker, owl, and hawk are common bird species. Reptiles such as lizards and snakes are numerous due to their adaptation to desert areas and ability to conserve body fluids. Many types of mammals live in desert areas and are primarily found near water sources.

d. Human Population. Humans are greatly influenced by the presence of water and they live close to rivers, wells, cisterns, or oases. For example, in the Sahara Desert, the 2 million people inhabiting this area are located near about 50 desert oases and small coastal cities. In the Gobi Desert, the Mongols live in scattered camps and move from one well to the next as they travel. In the southwest deserts of America, the population is greater along the Colorado and Rio Grande rivers.

11-5. Warm Temperate Climates:

a. The temperate zone is the area or region between the Tropic of Cancer and the Artic Circle and between the Tropic of Capricorn and the Antarctic Circle. The

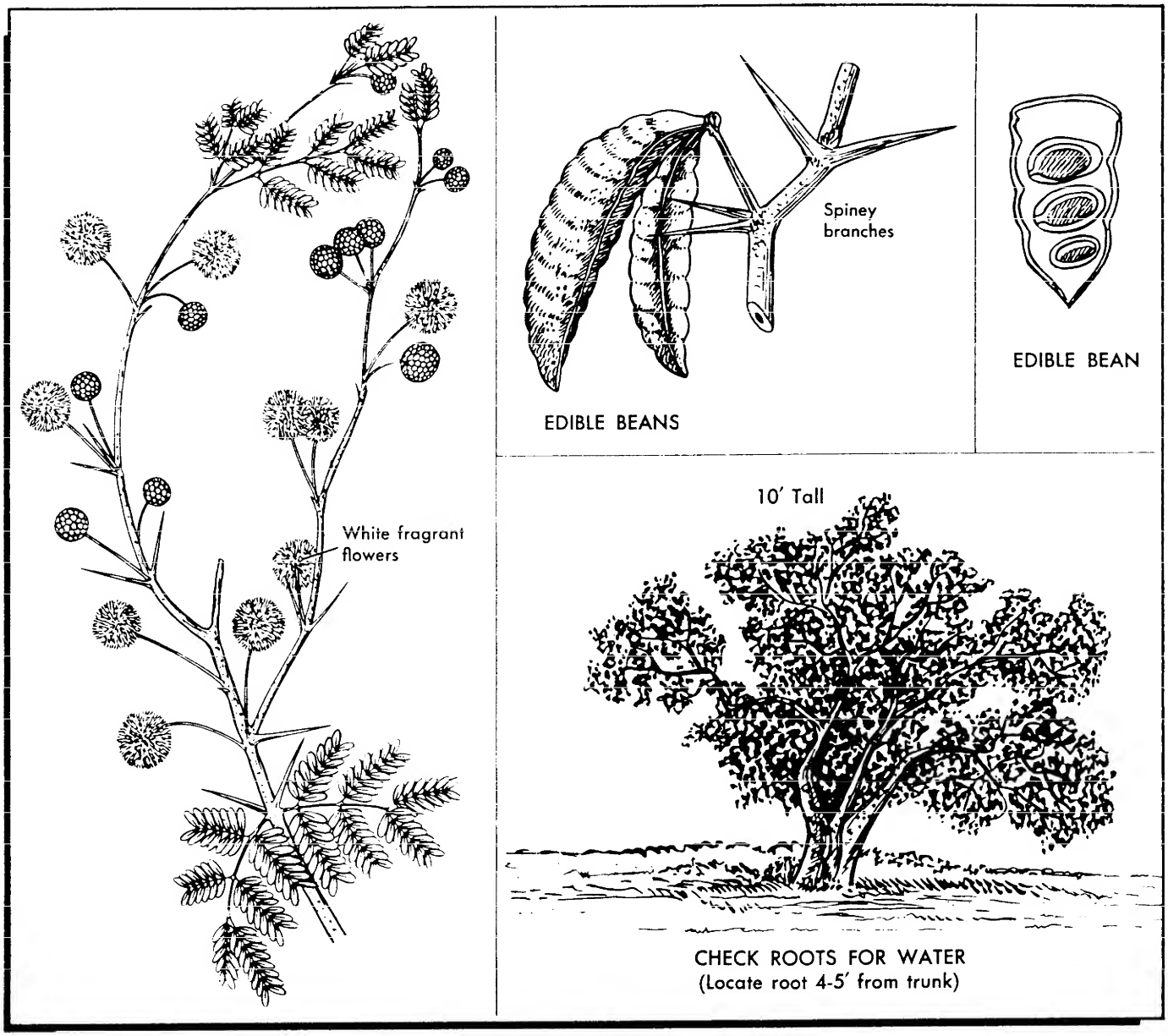

Figure 11-18. Acacia.

latitudes which comprise the temperate zone are 23½° north latitude to 66½° north latitude and 23½° south latitude to 66½° south latitude.

b. There are two main types of climate which comprise the temperate group—mild type, dominated by oceanic or marine climate; and a more severe one called continental climate.

(1) The temperate oceanic climate is the result of warm ocean currents where the westerly winds carrying moisture have a warming effect on the landmass. This oceanic type climate cannot develop over an extensive area on the eastern or leeward side of large continents in the middle latitudes. The extended effect of the ocean climate can be limited by mountain ranges. Such is the case with the Olympic, Cascade, and Rocky Mountains. As the oceanic weather system moves across the Olympic Mountains, it drops nearly 300 inches of precipitation annually. On the windward side of the Cascades, the annual precipitation ranges from 80 to 120 inches annually. In contrast, the region from the leeward side of the Cascades is a relatively dry area, receiving between 10 to 20 inches precipitation annually. As the system moves across the Rocky Mountains, most of the remaining moisture is lost.

(2) The temperate continental climate is a land-controlled climate which is a product of broad middle latitude continents. Because of this, the continental climate is not found in the Southern Hemisphere. This type of climate is very characteristic of the leeward side of mountain barriers and eastern North America and

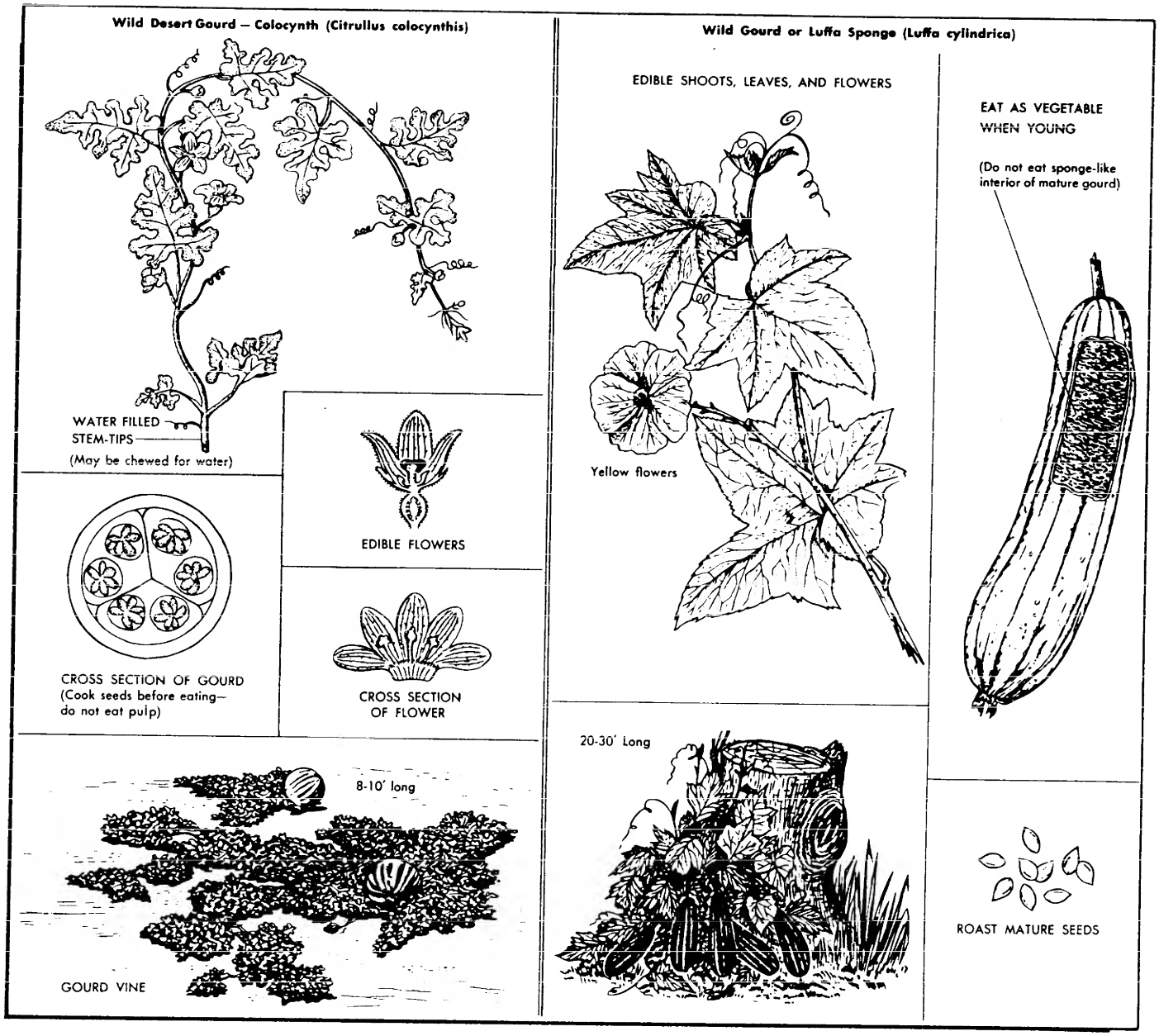

Figure 11-19. Wild Desert Gourd.

Asia. These areas are associated with dry interiors since there are few major warm-water sources available for formation of water systems. The average temperature in the winter and summer are not only extreme but also variable from one year to the next. The severe winter temperature is caused by the polar airflow toward the Equator, and neither winter nor summer temperatures are moderated by the effects of large water masses (oceans).

c. The climate within the temperate zone varies greatly in temperature, precipitation, and wind. The temperate (midlatitude) zone is divided into four major climate zones which are controlled by both tropic and polar airmasses.

(1) The humid subtropical zone is located generally between 20 and 30 degrees north and south latitude. This climate also tends to occur on the east coast of the continents which are at these latitudes. An example of this zone in the United States is the area between Missouri to lower New York and east Texas to Florida. The temperature ranges from 75°F to 80°F in the summer months to 27°F to 50°F in the winter months. The total average precipitation is 30 to 60 inches or more. During the summer months, convectional rainfall is common and thunderstorms frequent. In the winter, the rain is

* National Park Service, U.S. Dept. of the Interior. Photo by M. Woodbridge Williams

Figure 11-20. Marine West Coast Climate (Olympic Peninsula).

more widespread and is usually associated with passing midlatitude cyclones. The wind has a great influence in this area. The area is affected by both the prevailing westerlies and eastern trade winds. During the summer, the winds are influenced by eastern moist maritime airmass flows. Winters are influenced by westerly continental polar airflows. The weather is also influenced by low latitudes. The equatorial current which turns poleward forms warm currents (Gulf Stream and Japanese and Brazilian) that parallel the coasts.

(2) The marine west coast climate (figure 11-20) is sometimes referred to as the temperate oceanic climate. This climate is generally between 40 and 60 degrees north and south latitudes, on the west side of the continent. Examples are the west coasts of Washington to Alaska, Chile, nearly all of Europe, and New Zealand. The summer months are cool with average temperatures of 60°F to 70°F. The winter months are mild with temperatures averaging 27°F to 50°F. The total average rainfall ranges from 20 to 200 inches. Since the maritime climates are under the influence of the westerly winds all year, rainfall is nearly uniform from season to season. These climates are probably more cloudy than any other. They are characterized by widespread stratus and nimbostratus clouds and frequent fog. One of the main reasons for the tremendous rainfall in these climatic areas is the warm ocean currents. These currents yield moisture to the air which is blown inland by the westerly winds (figures 11-21 and 11-22).

(3) Middle latitude desert and steppe climates of complex origins are found generally between latitudes 35 to 50 degrees and in the interior of Asia and North America. Mountain ranges serve as barriers to the moist maritime airmasses, thus resulting in low levels of precipitation. In summer, these interiors generate tropical airmasses, while in winter they are overrun by polar air masses originating in Canada and Siberia. Deserts are also characterized by considerable differences between the average summer and winter temperatures. Of greater importance are the vast semi-dry steppes. Their annual precipitation of 10 to 20 inches supports short-grass vegetation. They comprise the great sheep and cattle ranges of the world; for example, the veldt of South Africa and the American Great Plains support vast numbers of animals.

(4) The Mediterranean climate is sometimes referred to as subtropical dry summer climate. It is generally located from 30 to 45 degrees north and south lati-

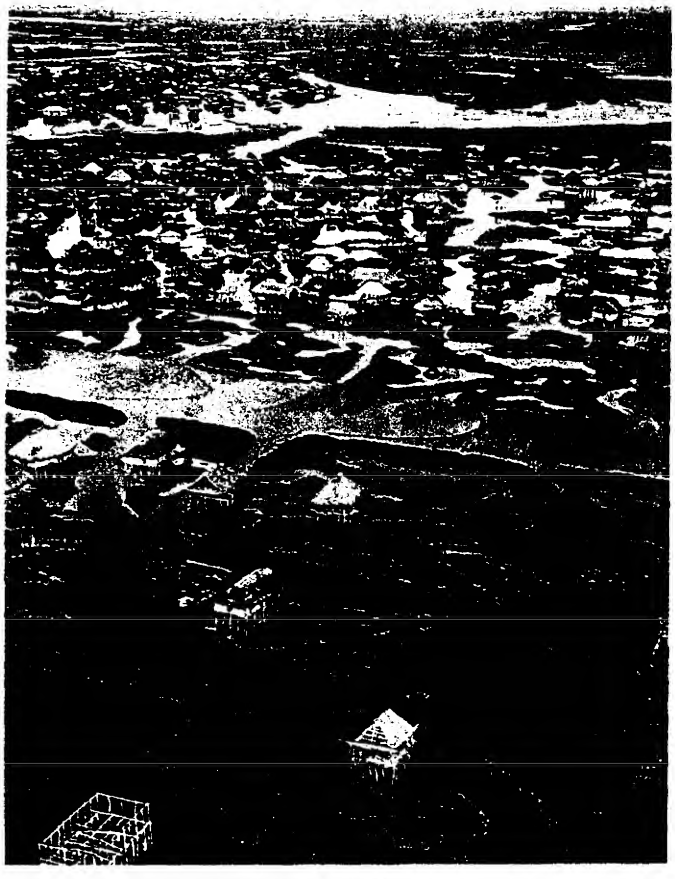

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Figure 11-21. Maritime Climate (Southern Dahomey, Africa).

tudes. Examples of this climate occur in the Mediterranean region, most notably Spain, Italy, and Greece. Summer temperatures usually average 75°F to 80°F; but in coastal locations near cool currents, the average is 5°F to 10°F lower. Typical temperature averages for the coldest months are 45°F to 55°F. Coastal locations are usually somewhat warmer in the winter than inland locations. Total annual rainfall is normally 15 to 30 inches along the equatorial margins and increases poleward. This climate is a transitional zone between the dry west coast desert and the wet west coast climate. The westerly winds and cold ocean currents are the controlling influences of the Mediterranean climate. An example of a cold current which affects climates are the Humbolt Current (Peru Current) along the coast of Chile, Peru, and California.

d. Major topographical characteristics found in temperate regions are:

(1) Mountains. Areas of steep slopes with local relief of more than 2,000 feet. Examples of this land form are the Rocky Mountains of North America, the Andes Mountains of South America, and the Himalayan Mountains of Asia.

(2) High Tablelands. Upland surfaces over 5,000 feet in elevation and having local relief of less than 1,000 feet, except where cut by widely separated canyons such as the High Tableland of the Wyoming Basin.

(3) Hills and Low Tablelands. Hill areas having local relief of more than 325 feet but less than 2,000 feet. At the ocean shoreland, however, local relief may be as low as 200 feet. A low tableland is an area less than 5,000 feet in elevation with local relief less than 325 feet, but which (unlike plains) either does not reach the sea or where it does, terminates in a bluff overlooking a low coastal plain. Examples of this terrain can be found in the Appalachian Mountains, Quebec, Southern Argentina.

(4) Plains. Surfaces with local relief of less than 325 feet. On the marine side, the surface slopes gently to the sea. Plains rising continuously inland may attain elevations of high plains—over 2,000 feet. The greatest expanses of plains occur in the center of the North American Continent, Eastern Europe, and Western Asia (figure 11-23).

(5) Depressions. Basins surrounded by mountains, hills, or tablelands which abruptly outline the basins. Examples of depressions can be found in the southwestern United States.

e. There are several biomes of plants and animal life within the temperature zone, and the characteristic life forms are dependent upon climatic characteristics within a specific area. The biomes are named for the plants most plentiful in the area.

(1) Coniferous Forests (figure 11-24). These occur in a broad band across the northern portions of the continents of North America, Europe, and Asia. The northern boundary is the tundra and the southern limits are generally around 50 degrees north latitude. However, this zone extends down to 35 degrees north latitude in the mountainous regions of the western North American continent. This biome corresponds with the humid continental climate, except in the mountainous portions of North America below 50 degrees north latitude. The main life forms in this zone are the conifers or needle leaf, cone-producing trees, such as pines, firs, spruces, and hemlock. In these areas, the trees may grow closer together, not being severely limited by a need for sunlight, and are subject to frequent fires caused by lightning. When this occurs, the ecological succession is reversed, allowing low shrubs to spring up in the burned-over areas. Although the conifer is the predominate tree, there is more subclimax or secondary growth in these biomes than in climax forests (mature or primary forests). In these areas, the pines, alders, aspen, and poplars are the dominant trees. The dominant shrubs are heather, small maples, and yews. If forced to survive in these areas for long periods, especially in winter, the survivor will find that edible food plants are scarce (figure 11-25).

Photo by Daniel Yacke

Figure 11-22. Red Mangrove and Swamps.

(a) In winter, the primary edible food plants available are:

-1.Rootstalks.
-2.Bulbs.
-3.Roots.
-4.Seeds.
-5.Resins (from pines).
-6.Infusion (teas) from evergreen needles.
-7.Bark (inner part).

(b) During the summer months, many more plants are available for food, including:

-1.Nuts.
-2.Sweet Acacia.
-3.Water Plantain.
-4.Shoots (potherbs).
-5.Wild Apple.
-6.Polypody.
-7.Leaves (potherbs).
-8.Baobab.
-9.Wild Rhubarb.
-10.Pollen (cattail).
-11.Beechnut.
-12.Flowering Bush.
-13.Flowers.
-14.Braken (Fern).
-15.Wild Sorrel.
-16.Fruits (dessert).
-17.Wild Calla
-18.Cattail. (water Arum).
-19.Fiddleheads (Ferns).
-20.Chufa (Nut Grass).
-21.Chestnut.
-22.Wild Crabapple.
-23.Wild Dock.
-24.Chicory.
-25.Wild Filbert (Hazelnut).
-26.Wild Grape.
-27.Juniper.
-28.Common Jujube.
-29.Pine Nuts.
-30.Spreading Wood Fern.
-31.Wild Lily.
-32.English Oak (Acorn).
-33.Tree Fern.
-34.Water Lily (Temperate Zone).

(c) In many places, the ground is thickly covered with mosses and there may be a few varieties of early flowering plants and many berry-bearing shrubs which invite birds and mammals into the open areas. Some of the largest herbivores (plant eaters) live in these evergreen forests—caribou, reindeer, moose, and deer. The small herbivores may include porcupines, several species of squirrels, mice, and rabbits. The carnivores (flesh eaters) which feed upon the smaller animals include black bear, gray wolf, lynx, wolverine, red fox, and weasel. Multitudes of insects provide food for the birds. (These insects may also present a menace to the survivor). A large variety of birds feed not only on insects but also on plants.

(2) Deciduous Forests. Decodipis (broad leaved) forests are found extensively in the eastern portion of the United States; in Europe, between 40 to 50 degrees north latitude; and also in eastern portions of the USSR, China, Korea, and Japan from 35 to 50 degrees north latitude. This biome corresponds with the subtropic and humid continental climatic zones; the area in which any deciduous forest group determines the predominant trees or climax vegetation found there. Here are a few examples: In north central United States, Beech and Maple trees assume the dominant role; in Wisconsin and Minnesota, it is Basswood and Maple; in the eastern and southern regions, the dominant trees are

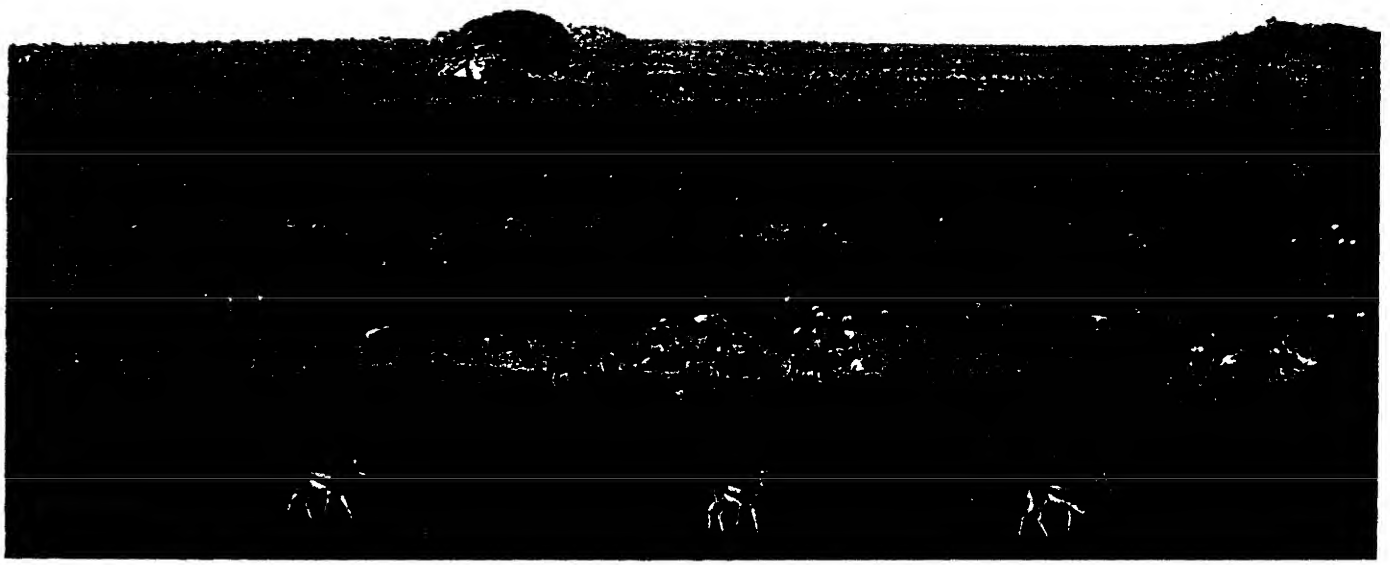

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Figure 11-23. Plains.

Oak and Hickory (figure 11-26). There are also spots in this biome where pines and broadleaf evergreens grow.

(3) Deciduous and Mixed Deciduous-Coniferous Forest:

(a) Deciduous and mixed deciduous-coniferous forests manifest the following characteristics:

-1. Warm summer with rain; winters cold and drier; short drought periods.

-2. Only three stories of vegetation (trees, scrubs, herbs).

-3. Broadleaf trees without leaves in winter.

-4. Mature trees, uniform in height.

-5. Unimpeded view into interior of forest.

-6. Few herbs, ferns, mosses in summer, and abundance of edible fungi in spring and autumn.

-7. Trunks of trees covered with thick-fissured, dark-colored bark.

-8. Resting buds enclosed in hard scaly protecting leaves frequently covered with gum or resin.

-9. For the most part, leaves are thin and delicate, rarely thick and leathery like those of tropical rain forest trees.

(b) The deciduous and mixed deciduous-coniferous forests that predominate over much of eastern United States are typical of this vegetation type. The deciduous forest is wholly temperate in character. By contrast with the tropical evergreen forest with its richly shaded but chiefly dark glossy green canopy, the broadleaved temperate forest extends in a uniformly bright green expanse. The temperate deciduous and mixed deciduous-coniferous forest vegetation type occupies extensive areas in several parts of the world (figure 11-27).

-1. North America. Eastern United States.

-2. South America. Southern Chile, southeastern Brazil.

-3. Europe. Western and northern Europe, southern Scandanavia, southeastern Europe (Balkans).

-4. Asia. South central Siberia, southeastern Siberia and part of Manchuria, Korea (throughout), Japan (throughout), China (throughout except the extreme south and extreme north).

-5. Oceania. New Zealand.

(c) A general characteristic of a climax forest is the stratification of layers of plant growth similar to the canopy systems in the tropical rain forest. In a climax forest, there are usually a limited number of flowering plants, ferns, and shrubs for ground cover. The edible food plants in the vegetation zone are numerous, and a large array of edible species are available and include:

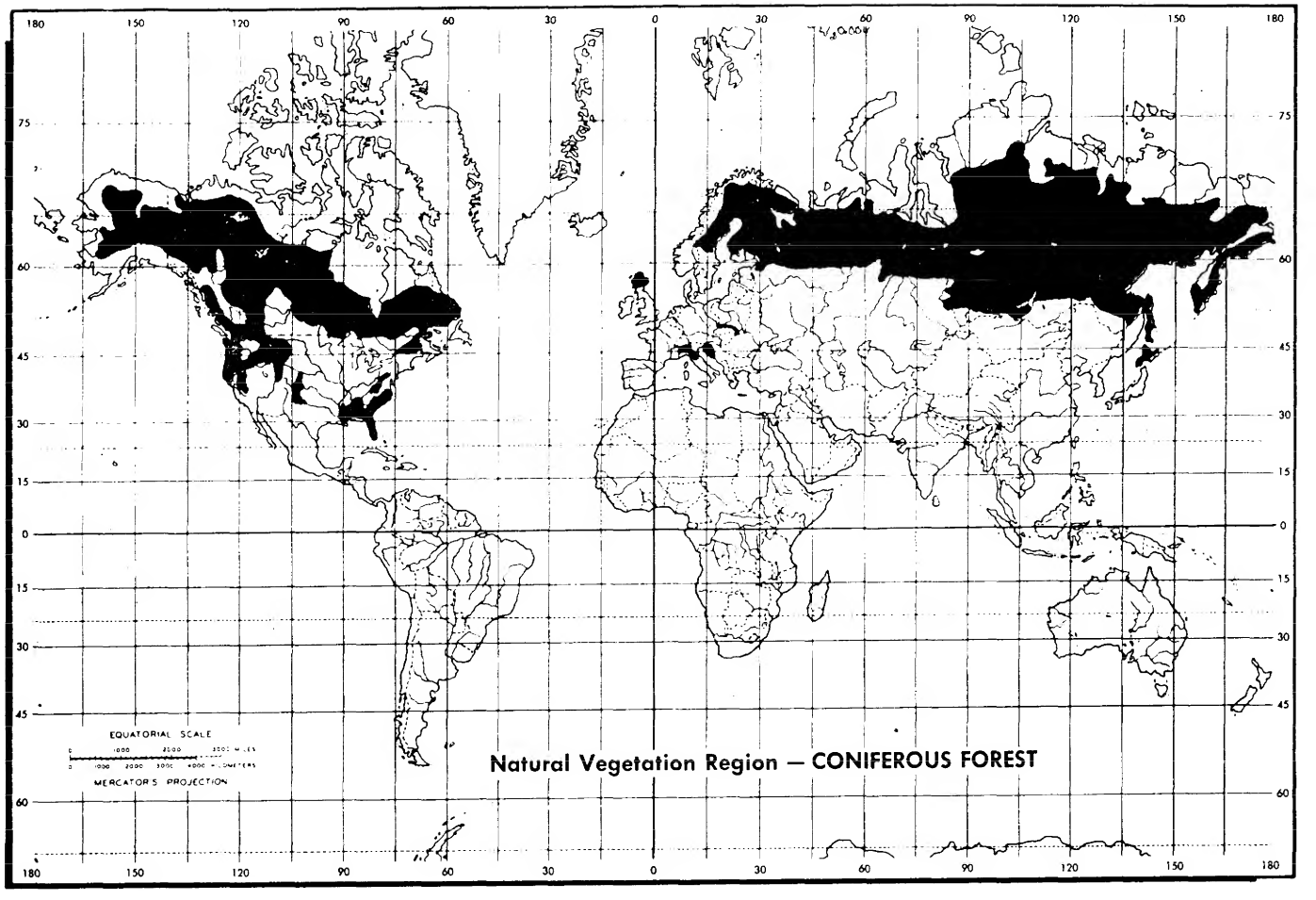


Figure 11-24. Coniferous Forest.

-1.Amarath.
-2.Chestnut, Water (Trapa Nut).
-3.Wild Lily.
-4.Wild Apple.
-5.Chicory.
-6.Lotus Lily.
-7.Beechnut.
-8.Chufa (Nut Grass).
-9.Mulberry.
-10.Braken (Fern).
-11.Wild Filbert (Hazelnut).
-12.English Oak (Acorn).
-13.Wild Calla (Water Arum).
-14.Wild Grape.
-15.Wild Onion.
-16.Cattail.
-17.Common Jujube.
-18.Pine Nuts.
-19.Chestnut.
-20.Juniper.
-21.Polypody.
-22.Air Potato (ubi Tuber).
-23.Tree Fern.
-24.Wild Dock.
-25.Purslane.
-26.Wild Tulip.
-27.Water Plantain.
-28.Wild Rhubarb.
-29.Walnut.
-30.Pokeweed.
-31.Flowering Rush.
-32.Water Lily.
-33.Tropical Yam.
-34.Wild Sorrel.
-35.Wild Crabapple.

(d) Animal life associated with deciduous forests is more varied and plentiful than in evergreen forests, though some animals such as certain species of deer, squirrels, martins, lynx, and wildcats are common in both areas. Wolves, foxes, and other small carnivores (flesh-eating animals) feed mainly on small rodents. Some forest dwellers, such as rodents, dig their dens below the ground while other dens are dug near streams where food and shelter are found. In the aquatic environment, the beaver builds dams for food and shelter. Muskrat, otter, and mink also seek the water's edge, while snakes, turtles, and frogs are found in the streams or lakes.

(4) Steppes and Prairies: (See figure 11-28.)

(a) The part of Russia extending from the Volga River through central Asia to the Gobi Desert has been referred to as the steppes. However, as a vegetation type, the steppe grasslands occur in many other parts of the world. The rainfall in steppe areas averages 15 to 30 inches per year, as compared to prairie areas which average 30 to 40 inches per year. The general aspect of a steppe area, like the prairie, is a broad treeless expanse of open countryside which may be quite rolling in places. The principal steppe areas are:

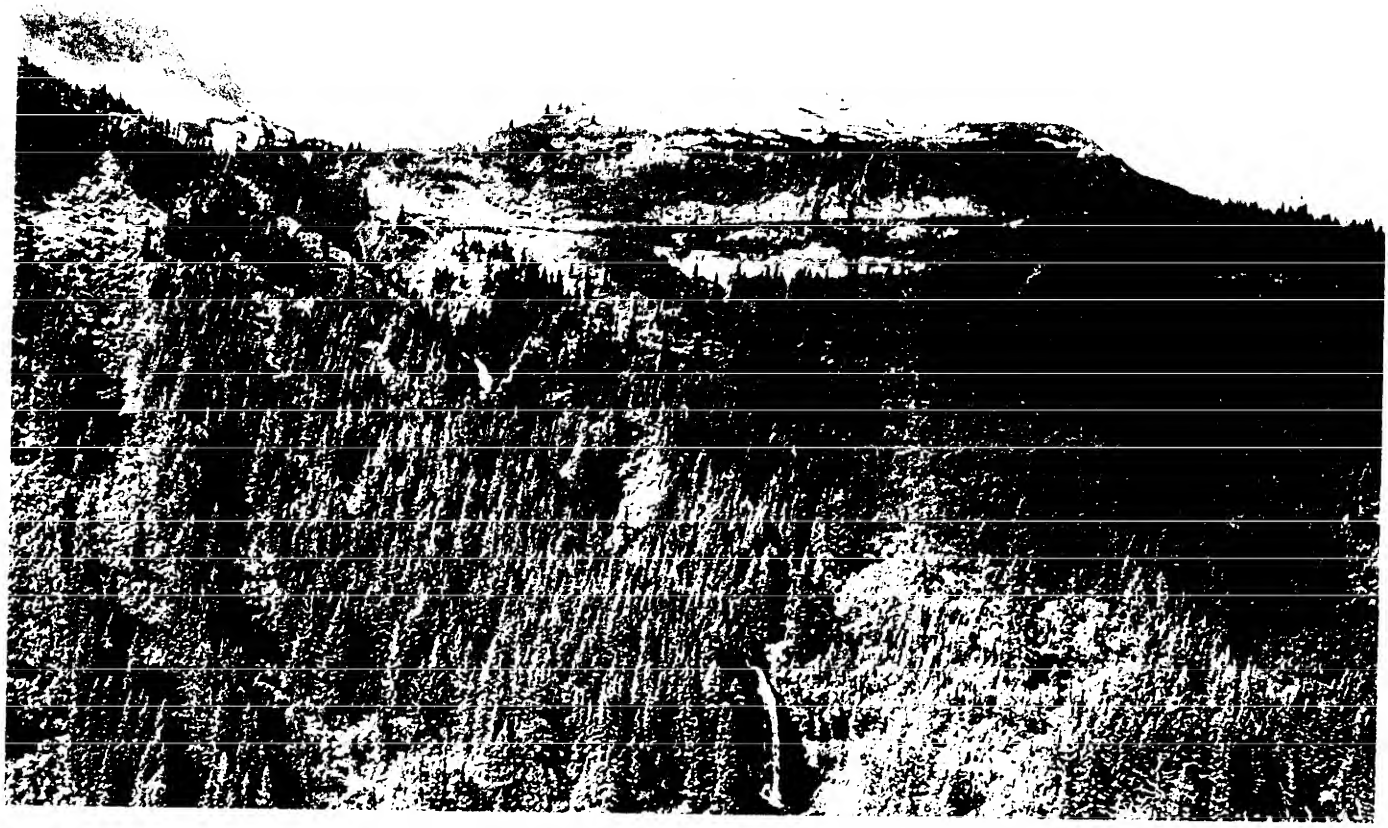


Photo by Daniel Yacko

National Geographic Society Photo by David Hiser

Figure 11-25. Coniferous Forest.

Photo by Daniel Yacko

Figure 11-26. Deciduous Forest.

-1. North America. Western Great Plains of the United States.

-2. South America. Argentina.

-3. Africa. Narrow belt extending across Africa on the southern rim of the Sahara, and parts of Ethiopia and Kenya.

-4. Europe. Southeastern Russia.

-5. Asia. Turkey, Iran, Baluchistan, Pakistan, Turkestan, and a broad belt through central Asia.

-6. Australia. Fringes of the great central desert, especially in eastern Australia.

(b) The prairie and steppe areas are very closely related. However, the true prairie supports a somewhat different flora than the steppe areas, and for this reason, it is important that they be discussed separately. The chief distinction between prairie and steppe is the seasonal distribution of rainfall.

	PRAIRIE	STEPPE
Rainfall per year	30-40 inches	15-30 inches
Subsoil	Permanently moist	Permanently dry

In both, the precipitation comes during the short growing season (spring). Summers are hot with intermittent showers. The primary prairie regions of the world are:

-1. North America. South central Canada, and east central United States.

-2. South America. Northeastern Argentina, Uruguay, Paraguay, and Brazil.

-3. Africa. Union of South Africa.

-4. Europe. Parts of Hungary, Rumania, and Russia (Ukraine and in a belt extending through central Russia to the Urals).

-5. Asia. Manchuria.

(c) The main plants in these biomes are grasses. Due to different conditions various characteristic grasses grow in specific areas on the prairies. The tall grasses are found near the edges of deciduous forests where larger amounts of water are available. The mid-grasses grow farther west, close to the Great Basin within the United States with short grasses growing in the rain shadows of the mountains. Wild flowers and other annuals are found throughout these regions. On the fringes of the desert, desert plants may have moved into the grasslands. The following are food plants of the steppes:

-1.Sweet Acacia.
-2.Wild Chicory.
-3.Wild Rose.
-4.Amaranth.
-5.Chufa (Nut Grass).
-6.Wild Sorrel.
-7.Baobab.
-8.Wild Dock.
-9.Wild Tulip.
-10.Wild Calla (Water Arum).
-11.Wild Onion.
-12.Water Lily.
-13.Cattail.
-14.Sea Orach.

(d) Common herbivores of the prairies are ground squirrels, prairie dogs, rabbits, gophers, and a great many species of mice. These are preyed upon by

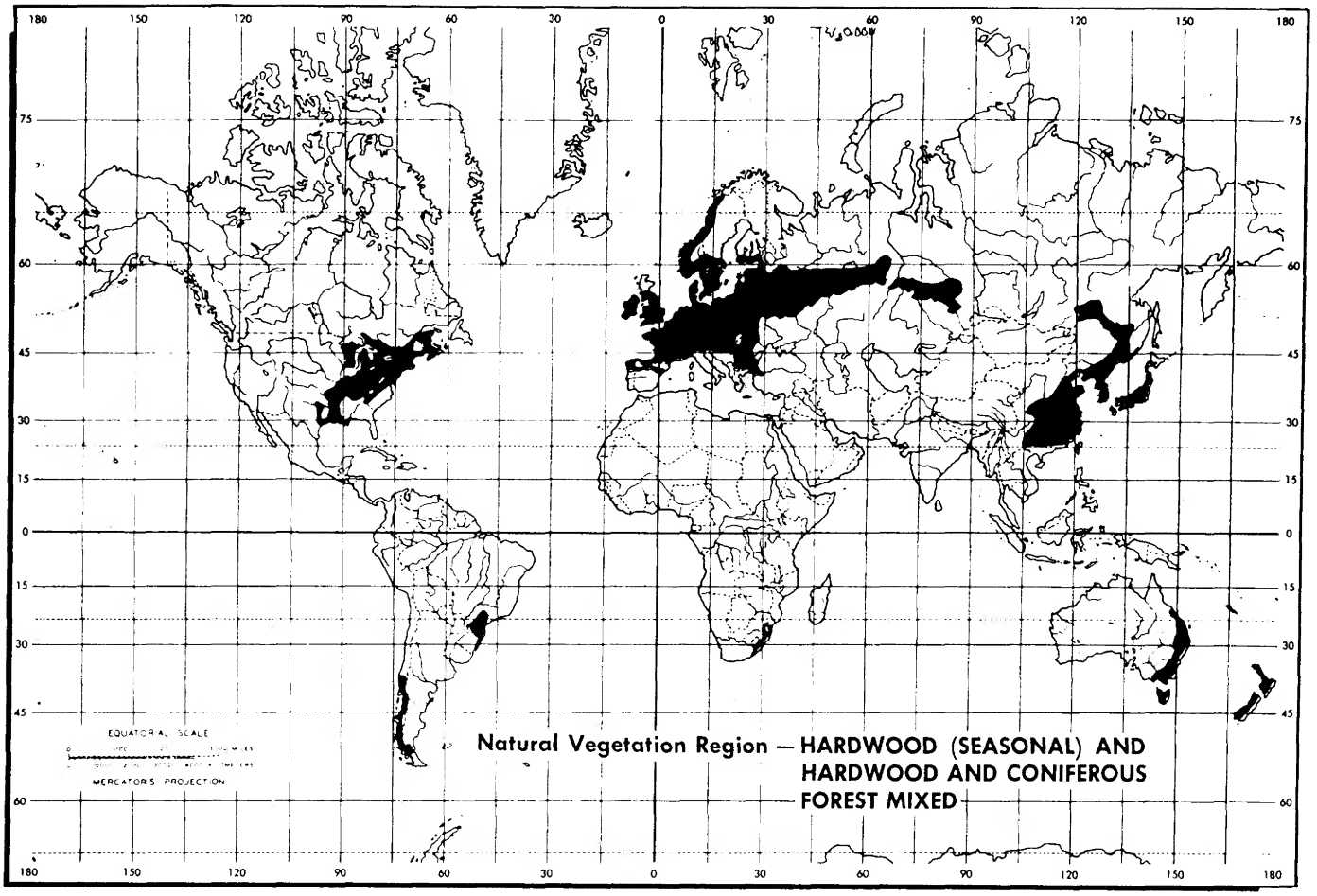


Figure 11-27. Hardwood (Seasonal).

badgers, coyotes, foxes, skunks, and hawks. Prairie animals travel in packs or herds which serve both to protect their individual members and assist in hunting prey. They typically have excellent vision and sense of smell, but their hearing, though keen, may be impaired by the noise of the pack or herd.

(e) A number of birds nest among the grasses. These include the meadowlark, prairie chicken, and grouse. During the dry season, some of these birds migrate to places better suited to raising their young.

(f) Insects like grasshoppers are well adapted to a grassland environment. The natural enemies of such insects are birds and reptiles which in turn become the prey of owls and hawks.

(5) Evergreen Scrub Forests. These biomes occur in southern California, in countries around the Mediterranean Sea, and in southern portions of Australia and correspond with the Mediterranean climate (figure 11-29).

(a) The major life form in this area is vegetation composed of broad-leaved evergreen shrubs, bushes, and trees usually less than 8 feet tall. This vegetation generally forms thickets. Sage and evergreen oaks are the dominant plants in North America in areas with rainfall between 20 and 30 inches. Areas with less rainfall or poorer soil have fewer, more drought-resistant shrubs such as manzanita. Scrub forest vegetation becomes extremely dry by late summer. The hot, quick fires that commonly occur during this period are necessary for germination of many shrub seeds and also serve to clear away dense ground cover. This ground cover is difficult for the survivor to penetrate. The branches are tough, wiry, and difficult to bend. Trees are usually widely scattered, except where they occur in groves near a stream. Usually, both trees and shrubs have undivided leaves. Grasses and brightly colored spring-flowering bulbs and other flowers may also be found. The survivor will find relatively few kinds of edible plant food within the scrub forest. During the growing season—usually only the spring months—the following kinds of plant foods are available:

-1. Agave (Century Plant). (See figure 11-30.)
-2. Wild Dock.
-3. Wild Pistachio.

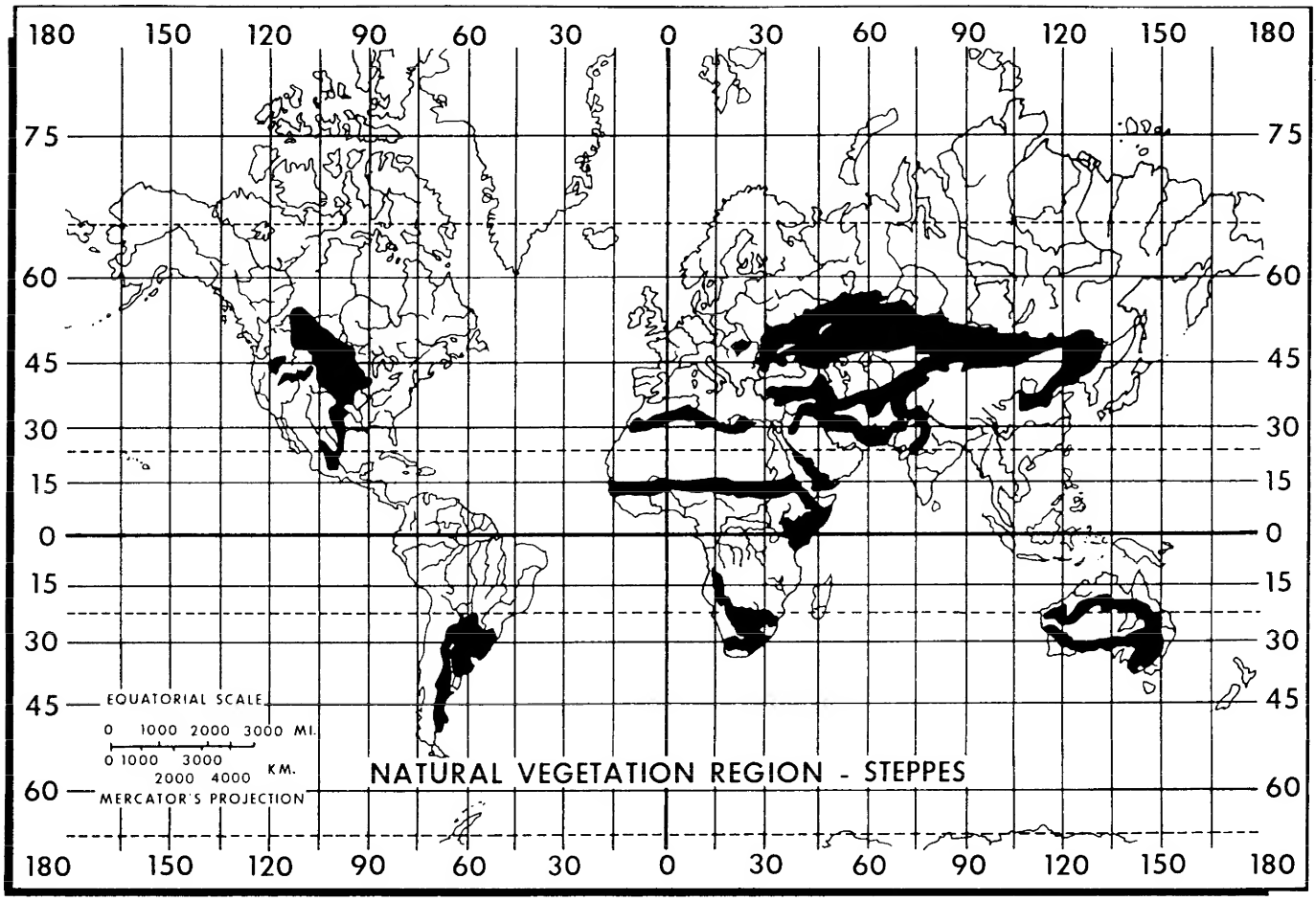


Figure 11-28. Steppes.

-4.Almond.
-5.Wild Grape.
-6.Wild Sorrel.
-7.Wild Apple.
-8.Juniper.
-9.Wild Tulip.
-10.Chicory.
-11.English Oak (Acorn).
-12.Walnut.
-13.Wild Crabapple.
-14.Wild Onion.

(b) Deer and birds usually inhabit these forests only during the wet season, which is the growth period for most scrub forest plants. Small dull colored animals such as lizards, rabbits, chipmunks, and quail are year-round residents.

11-6. Snow Climates. "Snow climates" are defined as the interior continental areas of the two great landmasses of North America and Eurasia that lie between 35 and 70 degrees north latitude. The tree line provides the best natural boundary for a topographical description of the snow climate areas. There are definite differences between the forest area to the south and the tundra to the north in snow-cover characteristics, wind conditions, animal types, and vegetation. Snow climates are comprised of two separate climate types: continental subarctic and humid continental.

a. The continental subarctic climate is one of vast extremes. The temperature may range from -108°F to 110°F. Temperatures may also fluctuate 40 to 50 degrees within a few hours. This area includes several climate subtypes. The largest areas run from Alaska to Labrador and Scandinavia to Siberia. They are cold, snowy forest climates, moist all year, with cool, short summers. A colder climate is found in northern Siberia which has very cold winters with an average cold temperature of -36°F. Another area is found in northeastern Asia where the climate is a cold, snowy forest climate with dry winters. Winter is the dominant season of the continental subarctic climate. Because freezing temperatures occur for 6 to 7 months, all moisture in the ground is frozen to a depth of many feet.

b. The humid continental climates are generally located between 35 and 60 degrees north latitude. For the most part, these climates are located in central and eastern parts of continents of the middle latitudes. These climates are a battle zone of polar and tropical

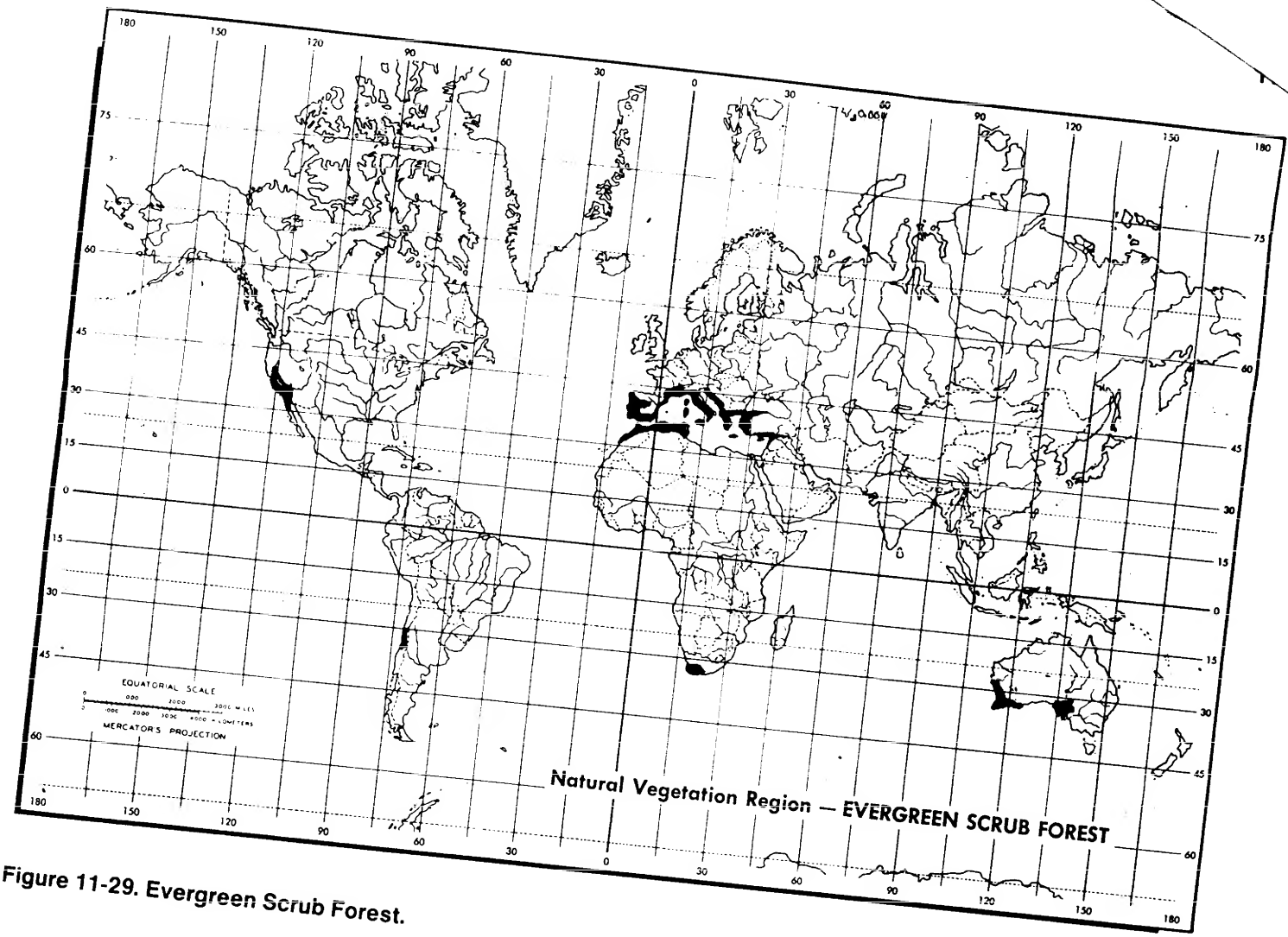
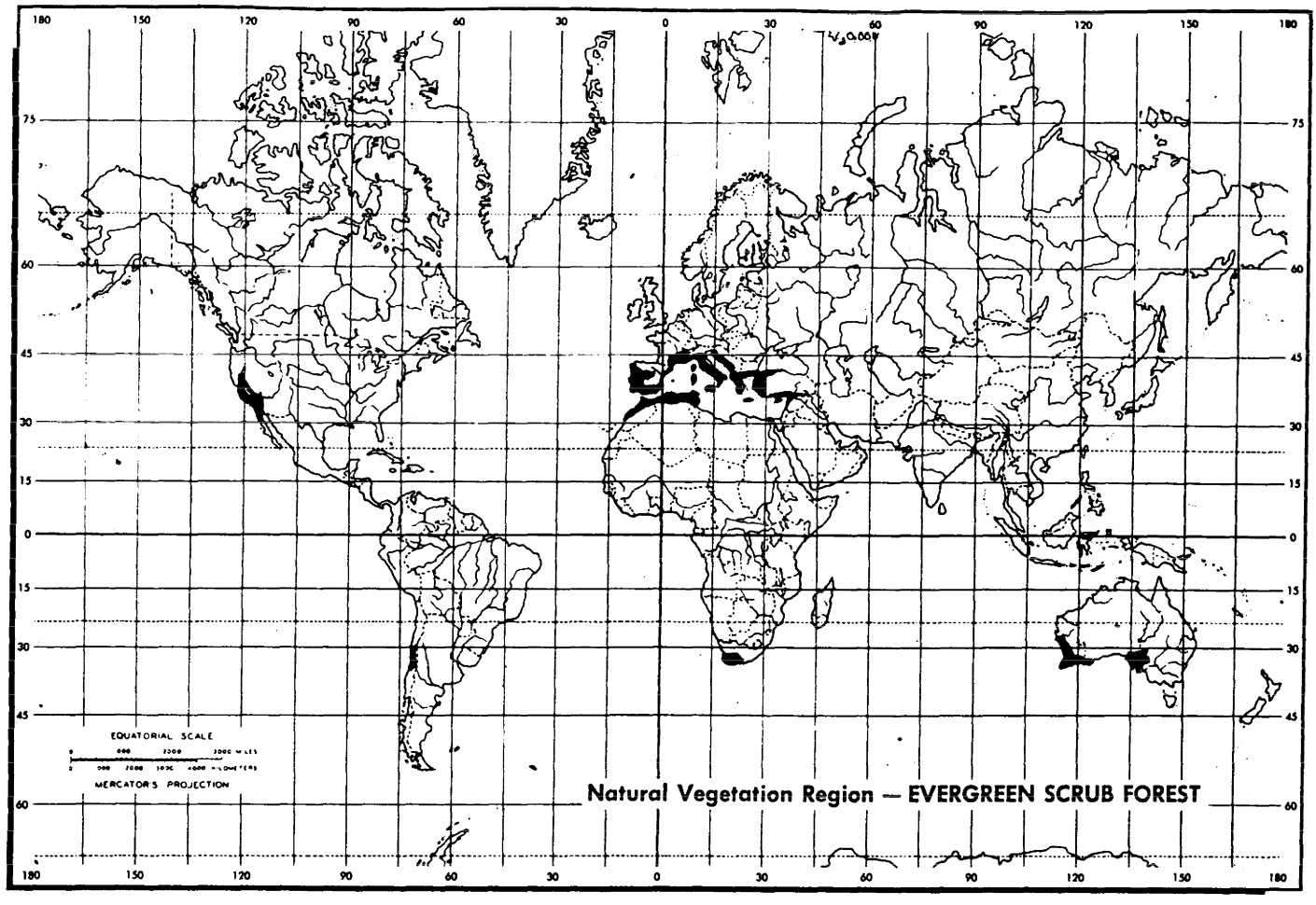


Figure 11-29. Evergreen Scrub Forest.

airmasses. Seasonal contrasts are strong and the weather is highly variable. In North America, this climate extends from New England westward beyond the Great Lakes region into the Great Plains and into the prairie provinces of Canada. This climate can also be found in central Asia. The summers are cooler and shorter than in any other climate in the temperate zone with the exception of the highland (Alpine) subarctic climate. The summer temperatures range from 60°F to 70°F. The winter temperatures range from -15°F to 26°F. The precipitation for the year varies from 10 to 40 inches. A higher percentage of the precipitation is snow, with less snow occurring in areas along the coasts. The weather is influenced by the polar easterly winds and the subtropical westerly winds. The effect of ocean currents on this continental climate is minimal. This climate is dominated by the high- or low-pressure cells centered in interiors of the continent.

c. Both climate regions have seasonal extremes of daylight and darkness resulting from the tilt of the earth's axis (figure 11-31). Snow climate nights are long, often continuous in winter; conversely, north of the Arctic Circle, the Sun is visible at midnight at least once a year. Darkness presents a number of problems to the survivor. No heat is received directly from the Sun in midwinter, thus the cold reaches extremes. Outside activities are limited to necessity, although the light from the Moon, stars, and auroras, shining on a light ground surface, is of some help. Confinement to cramped quarters adds boredom to discomfort, and depression becomes a dominant mood as time drags on. Fortunately, the period of complete darkness does not last long.

d. The terrain of the snow climate areas coincides with a great belt of needle-leaf forests. This region is found in the higher middle latitudes. Its poleward side usually borders on tundra and its southern margin usually adjoins continental temperate climates. This area is like the tundra because it has poor drainage. As a result, there are an abundance of lakes and swamps. The coastlines vary from gentle plains sweeping down to the ocean to steep, rugged cliffs. Glaciers are a predominate feature of the high altitudes (6,000-feet elevation or above). These glaciers flow down to lower elevations or terminate at the ocean.



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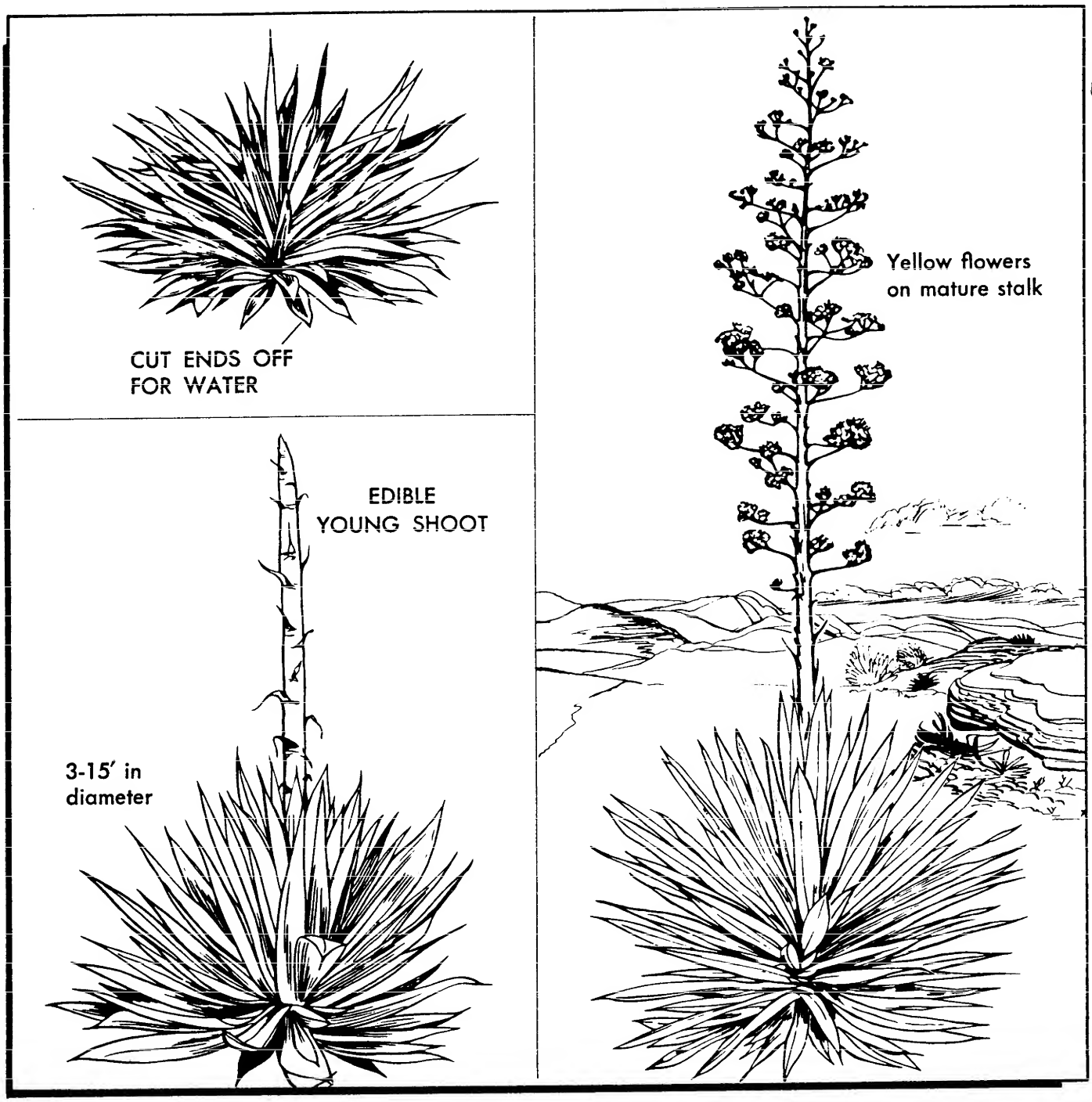

Figure 11-30. Agave (Century Plant).

e. The vegetation is similar to that found in more temperate zones; however, the cold temperatures have caused variations in the physical appearance of the plants. Dark evergreen forests thrive south of the tree line. They consist mainly of cedar, spruce, fir, and pine, mingled with birch. These subarctic forests are called taigas. A transitional zone lies between the taiga and the tundra. In this zone, the trees are sparse and seldom grow over 40 feet tall. Dwarf willow, birch, and alder mix with evergreens, and reindeer moss sometimes forms a thick carpet (figure 11-32).

f. Depending on the time of year and the place, chances for obtaining animal food vary considerably. Shorelines are normally scraped clean of all animals and plants by winter ice. Inland animals are migratory.

(1) Large Arctic Game. Caribou and reindeer migrate throughout northern Canada and Alaska (figure 11-33). In northern Siberia, they migrate inland to al-

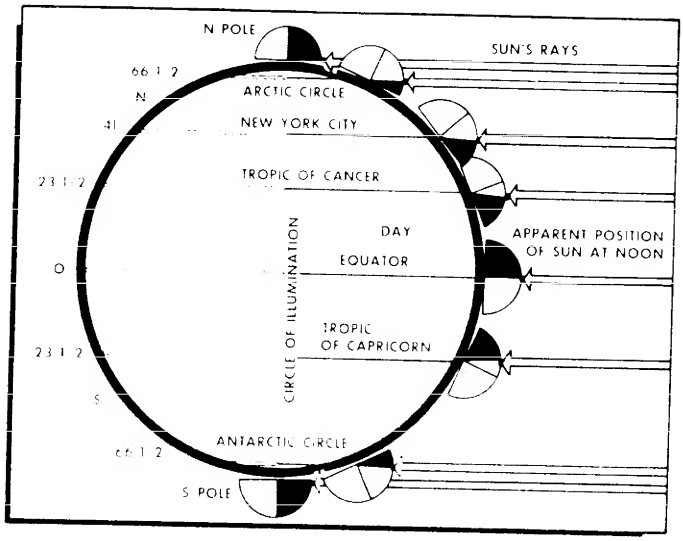

Figure 11-31. Circle of Illumination.

most 50 degrees north latitude. Some are found in west Greenland. All move close to the sea or into the high mountains in summer. In winter, they feed on the tundra. Musk oxen may be found in northern Greenland and on the islands of the Canadian archipelago. Sheep descend to lower elevations and to valley-feeding grounds in the winter. Wolves usually run in pairs or groups. Foxes are solitary and are seen most frequently when mice and lemming are abundant. Bears are dangerous, especially when wounded, startled, or with their young. They generally shun areas of human habitation.

(2) Small Land Game. Tundra animals include snowshoe and arctic hare, lemming, mice, and ground squirrels. They may be trapped or shot in the winter or summer. Most prefer some cover and can be found in shallow ravines or in groves of short willows. Ground squirrels and marmots hibernate in the winter. In summer, ground squirrels are abundant along sandy banks of large streams. Marmots live in the mountains, among the rocks, usually near the edge of a meadow or in deep soil—much like woodchucks. To find the burrow in rocky areas, look for a large patch of orange-colored lichen on rocks. This plant grows best on animal or bird dung, and the marmot always seeks relief in the same spot, not far from a well-hidden entrance.

g. The arctic is the breeding ground for many birds. In summer, ducks, geese, loons, and swans build their nests near ponds on the coastal plains or bordering lakes

Photo by Daniel Yacko

Figure 11-32. Subarctic Forest.

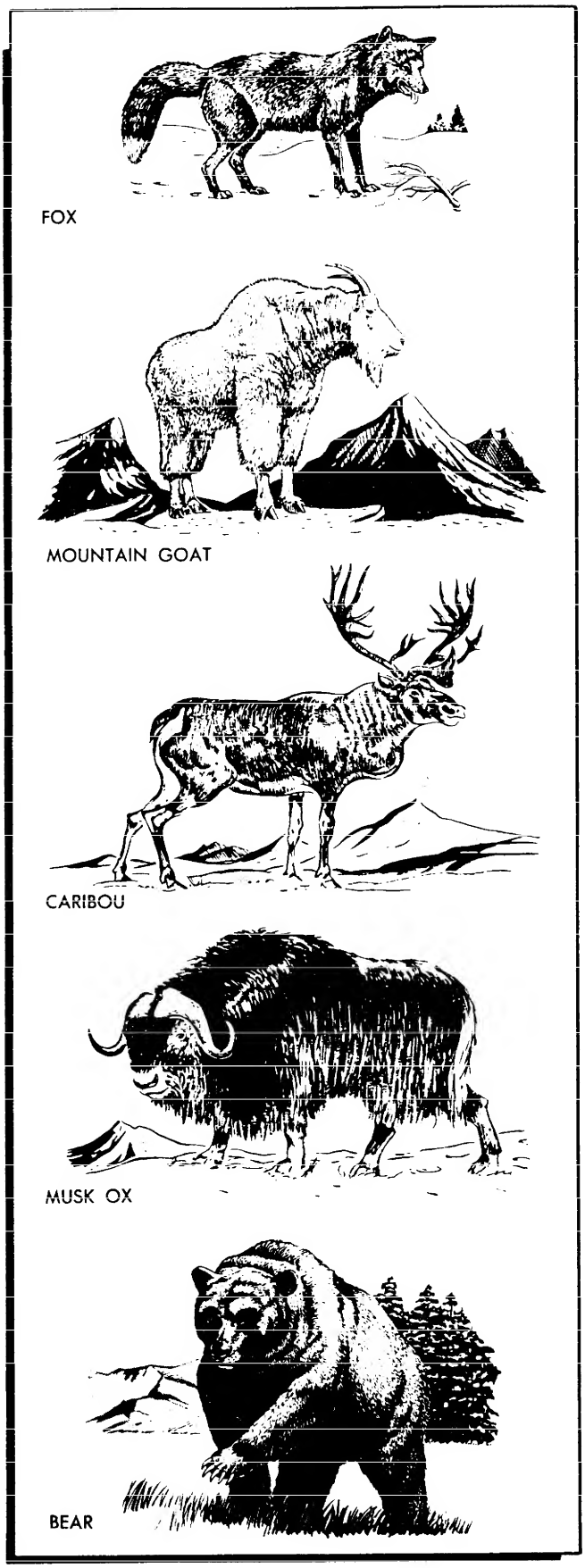

Figure 11-33. Arctic Game.

or rivers of the low tundra. A few ducks on a small pond usually indicates that setting birds may be found and flushed from the surrounding shores. Swans and loons normally nest on small, grassy islands in the lakes. Geese crowd together near large rivers or lakes. Smaller wading birds customarily fly from pond to pond. Grouse and ptarmigan, are common in the swampy forest regions of Siberia. Sea birds may be found on cliffs or small islands off the coast. Their nesting areas can often be located by their flights to and from their feeding grounds. Jaeger gulls are common over the tundra, and frequently rest on higher hillocks. In the winter, fewer birds are available because of migratory patterns. Ravens, grouse, ptarmigan, and owls are the primary birds available. Ptarmigan are seen in pairs or flocks, feeding along grassy or willow-covered slopes.

h. Arctic and tom cod, sculpin, eelpout, and other fish may be caught in the ocean. The inland lakes and rivers of the surrounding coastal tundra generally have plenty of fish which are easily caught during the warmer season. In the North Pacific and in the North Atlantic extending slightly northward into the Arctic Sea, the coastal waters are rich in all seafoods. Varieties include fish, crawfish, snails, clams, and oysters, and one of the world's largest and meatiest crabs—the king crab of the Aleutian Islands and Bering Sea areas. In the spring (breeding season), this crab comes close to shore and may be caught on fish lines set in deep water or by lowering baited lines through holes cut in the ice. Do not eat shellfish that are not covered at high tide. Never eat any type of shellfish that is dead when found, or any that do not close tightly when touched. Poisonous fish are rarer in the arctic than in the tropics. Some fish, such as sculpins, lay poisonous eggs; but eggs of the salmon, herring, or freshwater sturgeon are safe to eat. In arctic or subarctic areas, the black mussel may be very poisonous. If mussels are the only available food, select only those in deep inlets far from the coast. Remove the black meat (liver) and eat the white meat. Arctic shark meat is also poisonous (high concentration of vitamin A).

11-7. Ice Climates. There are three separate climates in the category of ice climates: marine subarctic climate, tundra climate, and icecap climate (figure 11-34).

a. Marine Subarctic Climate. Key characteristics of this climate are the persistence of cloudy skies and strong winds (sometimes in excess of 100 miles per hour) and a high percentage of days with precipitation. The region lies between 50 and 60 degrees north latitude and 45 to 60 degrees south latitude. The marine subarctic climate is found on the windward coasts, on islands, and over wide expanses of ocean in the Bering Sea and the North Atlantic, touching points of Greenland, Iceland, and Norway. In the Southern Hemisphere, this climate is found on small landmasses.

b. Tundra Climate. The tundra region lies north of 55 degrees north latitude and south of 50 degrees south latitude. The average temperature of the warmest month is below 50°F. Proximity to the ocean and persistent cloud cover keep summer air temperatures down despite abundant solar energy at this latitude near the summer solstice (figures 11-35 and 11-36).

c. Icecap Climate. There are three vast regions of ice on the Earth. They are Greenland and Antarctic continental icecaps and the larger area of floating sea ice in the Arctic Ocean. The continental icecaps differ in various ways, both physically and climatically, from the polar sea ice and can be treated separately (figure 11-37).

(1) Greenland. The largest island in the world is Greenland. Most of the island lies north of the Arctic Circle and ice covers about 85 percent of it. The warmest region of the island is in the southwestern coast. The average summer temperature is 50°F. The coldest region is the center of the icecap. The temperature there averages -53°F in the winter.

(2) The Antarctic. The Antarctic lies in a unique triangle formed by South America, Africa, and Australia. Surrounding the continent are portions of the Atlantic, Pacific, and Indian Oceans. The area is almost entirely enclosed by the Antarctic Circle. The climate is considered as one of the harshest in the world. The average temperature remains below 0°F all year. In the winter months, the mean temperature is from -40°F to -80°F. Winter temperatures inland often drop below -100°F. Great storms and blizzards (with accompanying high winds) range over the entire area due to both the continent's great elevation and by being completely surrounded by warm ocean water.

(3) Sea Ice on the Arctic Ocean. Ice on the Arctic Ocean includes frozen sea water and icebergs that have broken off glaciers. This ice remains frozen near the North Pole year around. Near the coast, the sea ice melts during the summer. Currents, tides, and winds may cause it to fold and form high ridges called pressure ridges. One piece of ice may slide over another causing a formation called rafted ice. When the ice breaks into sections separated by water, these sections are called leads. Great explosions and rolling thunder are caused by the breaking and folding of the ice.

d. Terrain. The terrain of the true ice climates encompasses nearly every variation known. Much of the landmass is composed of tundra. In its true form, the tundra

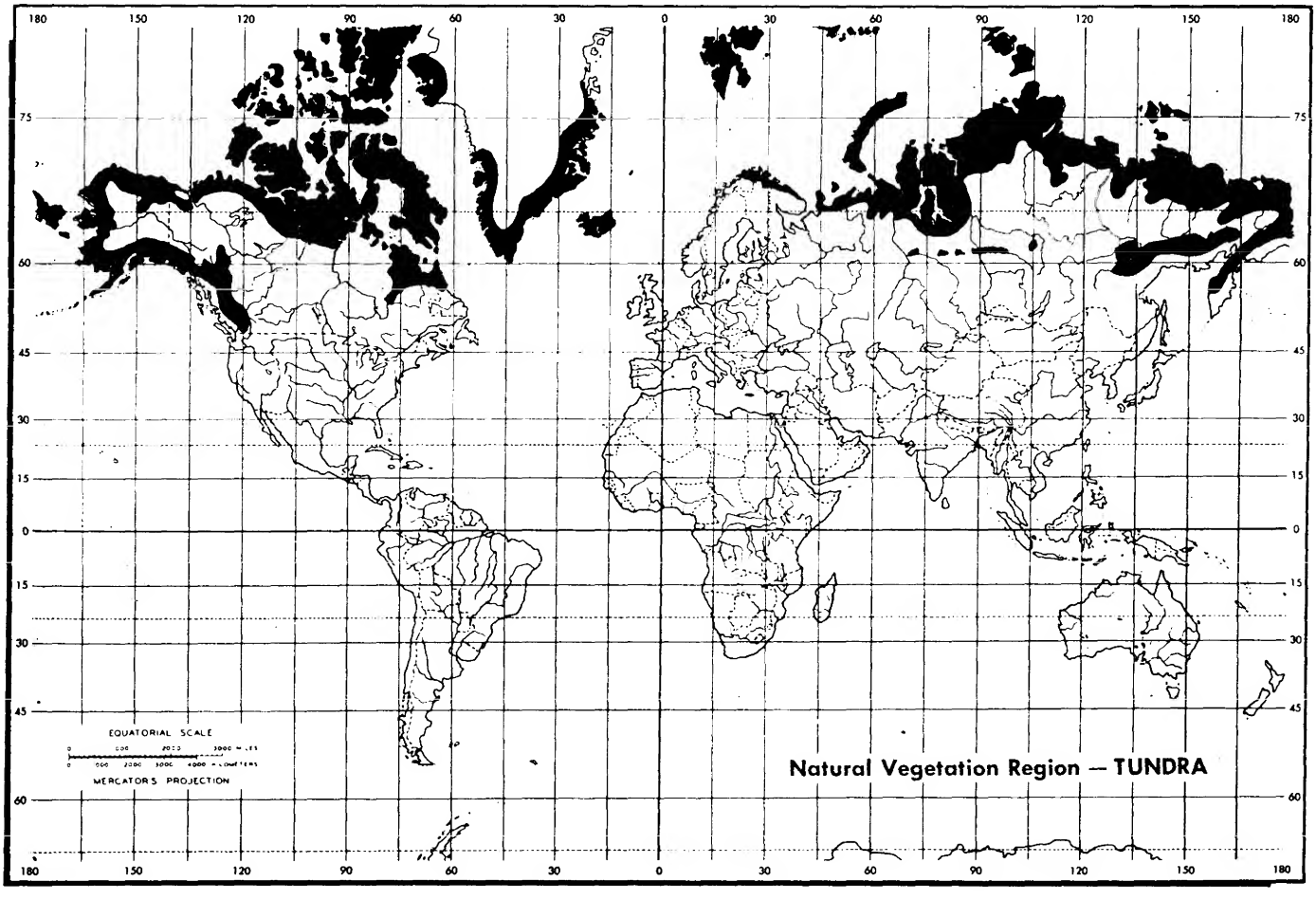

Figure 11-34. Tundra.

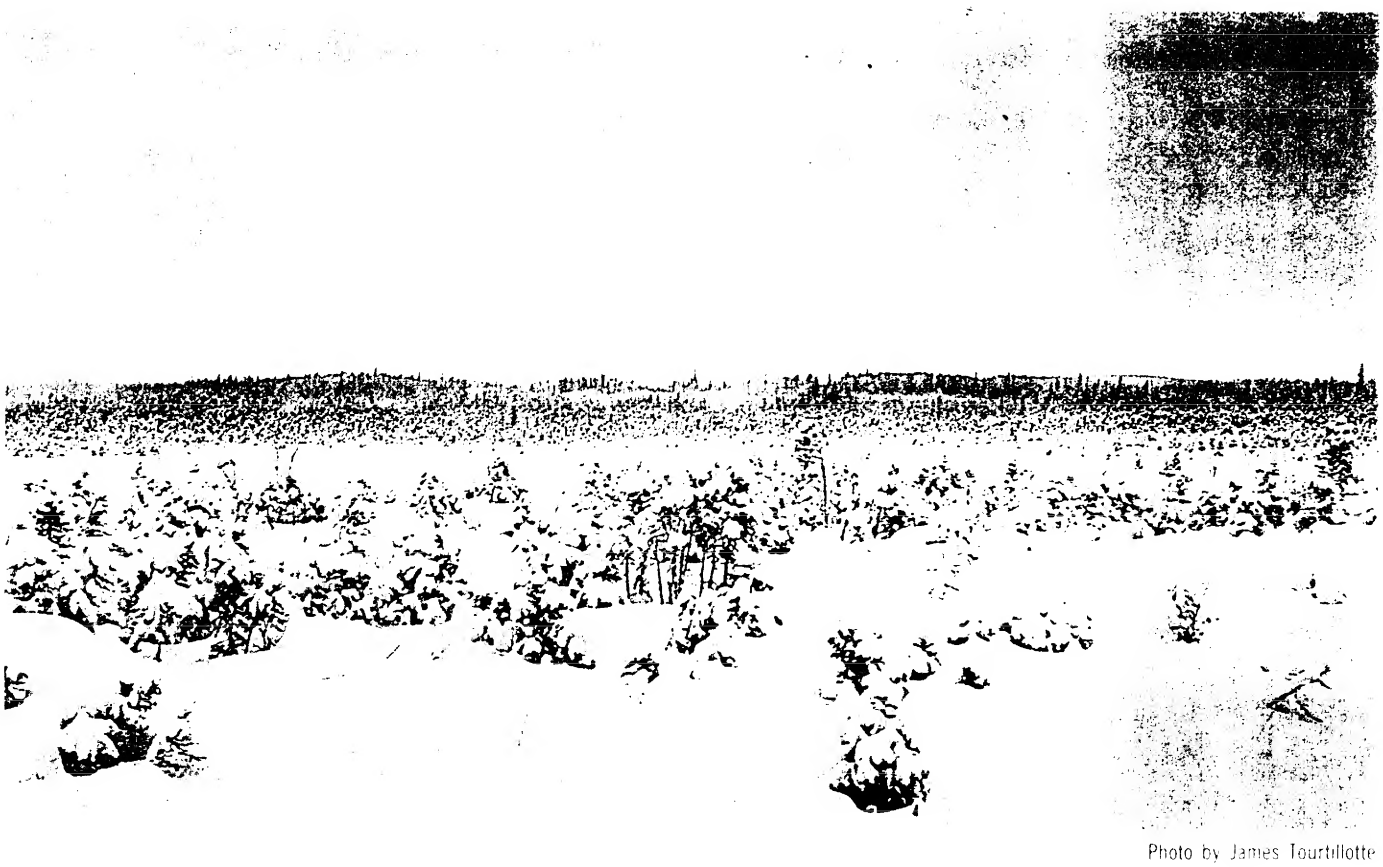

Photo by James Tourtillotte

Figure 11-35. Winter Tundra.

is treeless. Vast rugged mountain ranges are found in the area and rise several thousand feet above the surrounding areas. Steep terrain, snow and ice fields, glaciers, and very high wind conditions make this area a very desolate place. Continental glaciers such as the ice-caps covering Greenland and the Antarctic continent are large expanses of wind-swept ice moving slowly toward the sea. Ice thickness in continental glacier areas can exceed 10,000 feet.

e. Vegetation:

(1) Shrub Tundra. In Russia, the area surrounding the Lena River is known as a typical shrub tundra environment. Shrubs, herbs, and mosses occur in this zone. Arctic birch predominates but other shrubs occur and several may be useful as supplementary food such as the crystal tea ledum (Labrador tea), willows, and the bog bilberry. In this same shrub zone a lower herbaceous layer occurs which is composed of black crowberry, several grasses, and the cowberry. On the ground, mosses and lichens are present in abundance. The shrubs on the open tundra reach a height of only 3 to 4 feet but in valleys and along the rivers, the same shrubs may reach the height of a person.

(2) Wooded Tundra. The region immediately adjoining the treeless tundra is an extension of the coniferous areas of the south. These subarctic wooded areas include a variety of tree species of which the genus Picea (Spruce) predominates. On the Kola Peninsula of northeastern Scandinavia, these northernmost forests are birch. Siberian spruce occurs between the White Sea and the Urals. Siberian larch occurs between the Urals and the Pyasina River. Dahurian larch occurs between the Pyasina River and the upper reaches of the Anadyr River. In extreme northeastern Asia, Mongolian poplar, Korean willow, and birch are found along the rivers. The trees extending into the tundra are distinguished by their stunted growth (except in river valleys where they reach 18 to 24 feet) and sparseness. Permanent ground frost, or permafrost, penetrates most parts of the true tundra and the northern limits of the forest belt closely coincide with the southern limits of permafrost. A few different plants will cover very large areas so that extensive stands of a single variety of plant are common in the arctic tundra. All tundra plants are small in stature compared to the plants in the warmer climates of more southerly latitudes. The arctic willow and birch, for instance, spread along the ground in the tundra to form

Figure 11-36. Summer Tundra.

large mats. Stunted growth in all the woody plants is the rule, although there are many evergreen plants and hardy bulbous or tuberous plants. Lichens, especially reindeer moss, are widespread in the tundra. As mentioned before, the plant life of the tundra is remarkably uniform in its distribution. Some species are common to all three areas, but other species are more restricted in their distribution. The tundra also contains many species of vegetation found in the forest regions to the south (figure 11-38).

(3) Bogs. The tundra has often been classified as a continuous bog, but this is far from the truth. Many bogs do exist. There are also many hilly and even mountainous areas with considerably drier soil. The moss, or sphagnum bog is less common than the sedge bog. A characteristic of more southern tundras is the development of large peat mounds 9 to 15 feet high and 15 to 75 feet in diameter. These mounds have been formed by ground upheavals caused by freezing water. Many edible plants grow on these bog mounds, such as the cloudberry, dwarf arctic birch, bog bilberry, black crowberry, crystal tea ledum, sheathed cotton sedge, cowberry, and others.

f. Animal Life. Compared to other parts of the world, animal life is poor in species but rich in numbers. Large animals such as caribou, reindeer, and musk oxen migrate through the tundra areas. Carnivores—wolves, foxes, lynx, wolverines, and bears—range through the landmass area and polar bears, seals, walruses, and foxes are found far out on the sea ice. Small animals are the most abundant animal life found and include hares, lemmings, marmots, mink, fishers, and porcupines.

(1) Bird life is very limited during the winter months, mainly owls and ptarmigan, but during the summer months millions of migratory waterfowl nest in the arctic tundra. Species include ducks, geese, cranes, loons, and swans, nesting in and around the swamps, bogs, and lakes of the tundra. The coastal areas are home for many species of sea birds during the summer months. The coastal waters and iceflows are rich in a variety of marine life such as seals, walruses, whales, crustaceans, and fishes.

(2) The freshwater rivers, lakes, and streams are teeming with many varieties of fish—salmon, trout, and grayling. Due to the amount of surface water in the tundra area, there are a large variety of insects. Some 40 to 60 species of mosquitoes, flies, and gnats inhabit the area.

(3) In the Antarctic, animals are virtually nonexistent. Only the lowest forms of animal life can live mainly on mosses and lichens. Marine animals, particularly whales, seals, and penguins, are found along the coastal regions. Sea birds are abundant in the summer and nest on the coastal regions and the islands. There are a few species of wingless insects, lice, ticks, mites, etc., which live off the bird population.

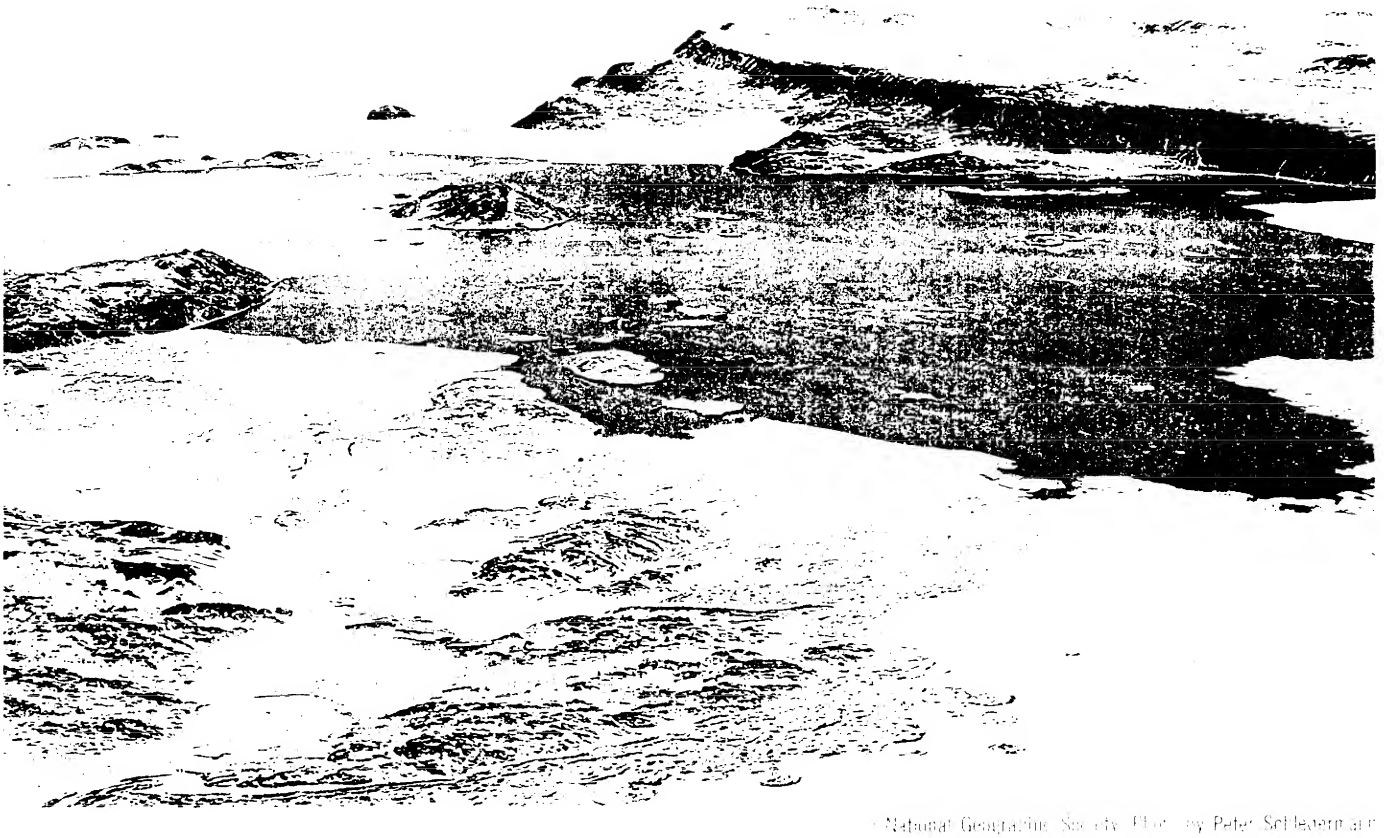

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Figure 11-37. Ice Climate.

11-8. Open Seas. The Köppen-Geiger system of climate classification has been used to describe the environmental characteristics of the landmasses. However, this system is not used to categorize the largest area of the world—the oceans. They are simply divided by their names and locations. All limits of oceans, seas, etc., are arbitrary, as there is only one global sea. The terms "sea" and "ocean" are often used interchangeably in reference to saltwater. However, from a geographic point of view, a sea is a body of water that is substantially smaller than an ocean or is part of an ocean.

a. The seas cover 70.8 percent of the Earth's surface. The waters are not evenly distributed, covering 61 percent of the surface in the Northern Hemisphere and 81 percent in the Southern Hemisphere. Traditionally, the seas are divided into four oceans: Atlantic, Pacific, Indian, and Arctic. These, with their fringing gulfs and smaller seas, make up the world's seas. If the land features of the Earth were smoothed out, the seas would cover the entire globe to a depth of 12,000 feet. Mount Everest, the tallest mountain peak (29,028 feet), would disappear without a trace in the 35,800-foot deep Marianas Trench in the western Pacific Ocean. The sea floor is made up of mountains, valleys, great plains, and deep trenches. The deepest trenches and tallest mountains are found in the north Pacific. The sea floor features do, to some extent, influence the surface properties of the seas; that is, currents, waves, and tides.

b. The average salinity of the seas is usually taken as 3.5 percent. Higher values occur at or near the surface in areas where high temperatures and strong, dry winds favor evaporation. The highest salinities occur in semi-landlocked seas at mid-latitudes such as the Red Sea, the Persian Gulf, and the Mediterranean Sea. The Pacific Ocean is the largest and is over twice the size of the Atlantic or Indian Oceans. Its size allows for greater climatic variations and more widespread influence. Due to similar latitudinal references the Atlantic and Pacific Oceans have many similar characteristics. The Indian Ocean is slightly smaller than the Atlantic, but is more significantly influenced by a continental landmass than

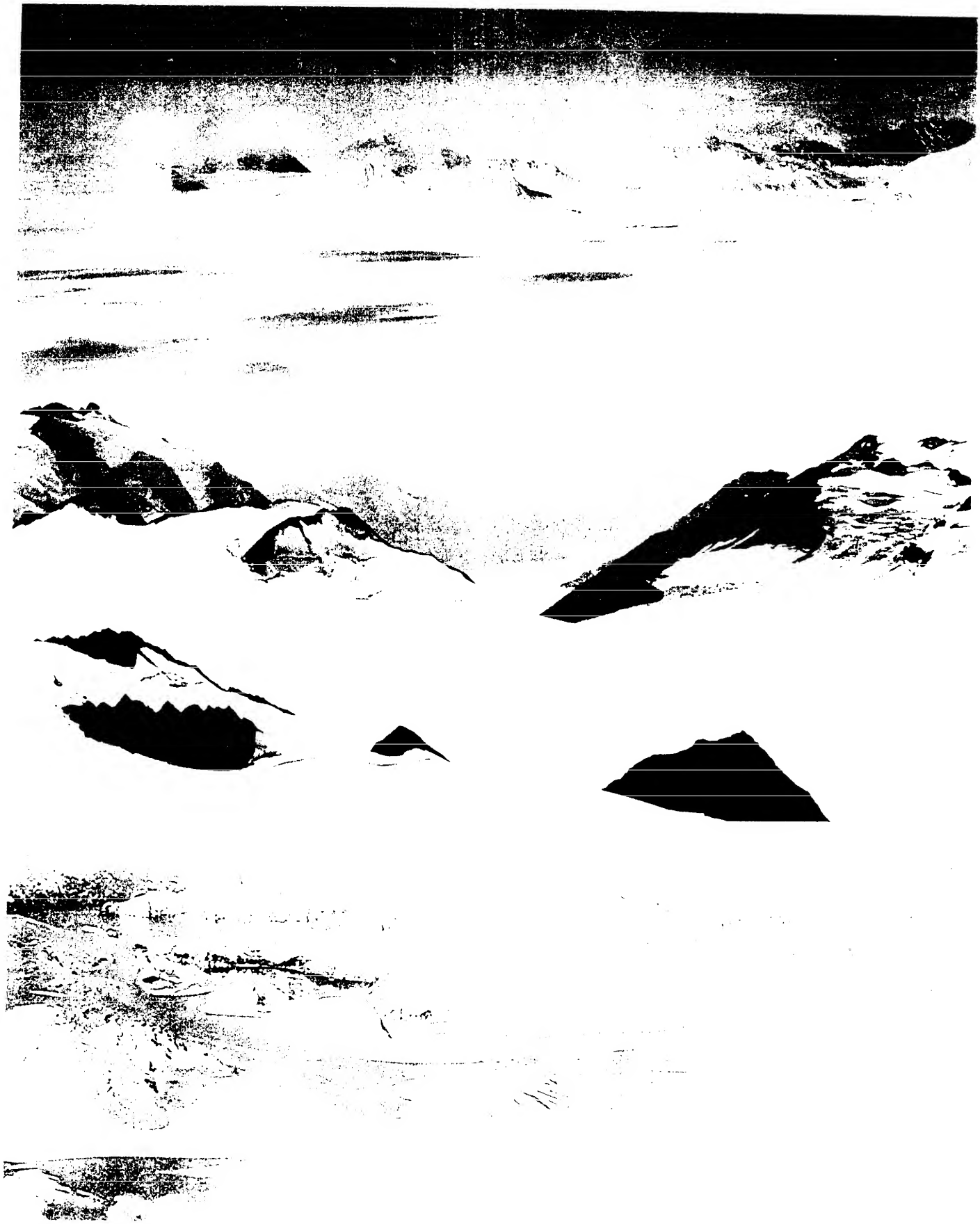


Figure 11-38. Arctic Zone Composite.

any other ocean. The Arctic Ocean is generally recognized as that body of water which lies north of 75 degrees latitude and is nearly enclosed by landmasses.

c. Within each of these four major oceans, numerous subdivisions known as seas, may be geographically aligned along indistinct boundaries (island chains; geography of ocean floor). Examples are:

(1) The Coral Sea is an arm of the South Pacific Ocean lying east of Queensland, Australia, and west of New Hebrides and New Caledonia. It extends from the Solomom Islands on the north to the Chesterfield Islands on the south.

(2) The Bering Sea is located between Alaska and Eastern Siberia, with its southern boundary formed by the arc of the Alaskan Peninsula and the Aleutian Islands. The Bering Strait connects it with the Arctic Ocean to the North.

d. Many water bodies are partially enclosed by land and are known as gulfs. An example would be the Gulf of Mexico.

11-9. Ocean Currents. The ocean has a complex circulation system made up of a variety of currents and countercurrents. These currents move at a rate from barely measureable to about 5.75 miles per hour. They may be relatively cold or warm currents and influence the climate and environment that exists on land and over the ocean. There is a constant movement of water from areas of high density, salinity, concentration, and pressure to areas of low density, salinity, concentration, and pressure in an attempt to establish an equilibrium. These factors influence the movement of ocean currents. However, the primary influence on ocean currents is the wind. They also may be diverted by the Coriolis Force and Continental Deflection (figure 11-39).

11-10. Climatic Conditions. To fully understand the general climatic conditions and seasonal variations that exist over the global sea, each major ocean must be examined separately, with the exception of the Atlantic and Pacific whose similar latitudinal references result in like characteristics (exceptions will be noted). The two physical phenomenons which have the greatest impact upon climate are currents and systems of high and low air pressures.

a. Currents with their basic characteristics of being either warm or cold and their inevitable convergence influence the environment of the open seas. Equally significant as the ocean influence on typical weather sequences (for example, temperature, wind, precipitation, and storms) are semi- and quasi-permanent centers of high and low atmospheric pressures. To observe their effect on climate, imagine a hypothetical voyage from the Pole to the Equator. The southern limit of the solidly frozen arctic icepack varies in latitude from about 65 to 75 degrees between February and August. In the winter, brief periods of calm, clear weather with a

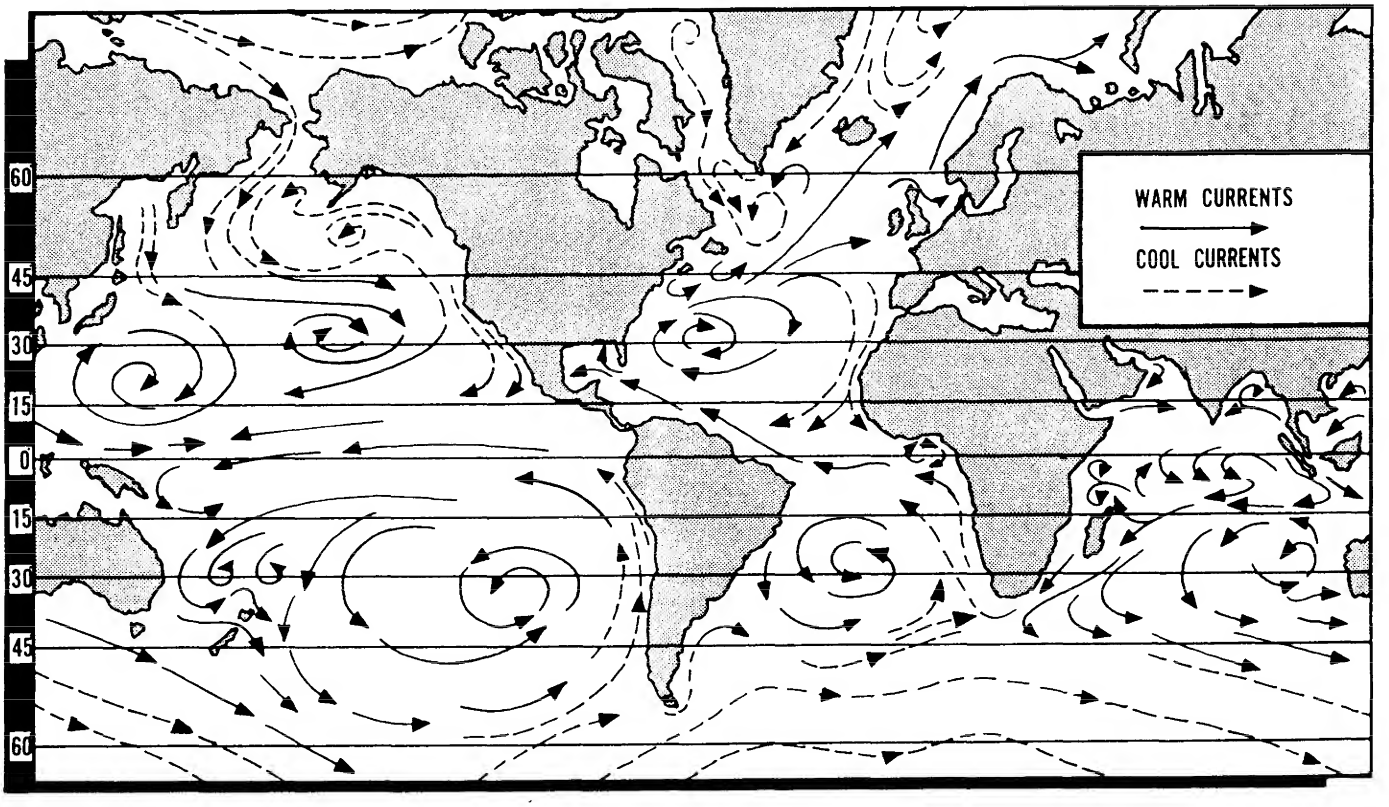


Figure 11-39. Ocean Currents.

mean temperature of -5°F are interspersed between passages of cyclonic storms characterized by snow, winds 30 to 40 mph, temperatures from -20°F to -30°F, and gale-force winds 30 percent of the time. In the summer, frequent periods of several days of calm or light variable winds with temperatures in the mid-40's may be experienced. Skies are uniformly overcast with layers of stratus or nimbostratus clouds. Dense fog banks are prevalent during calms. Rain or drizzle may continue for weeks at a time. One of the most stormy regions in the hemisphere is in the middle of the prevailing westerlies at 50 degrees north latitude. In the winter, calms are rare with winds of 15 to 20 knots and temperature near freezing. Every 2 to 3 days, a pale sun and scattered clouds give way to cumulostratus clouds and rain squalls. Wind intensity may reach 50 to 60 knots with temperatures dropping to -10°F to -15°F as the rain turns to sleet, soft snow, or hail. In the summer, protracted periods of fog, low stratus clouds, and drizzle exist with moderate breezes. The weather improves in the fall with a week or so of calm, clear weather in late September. As we move south to 40 degrees north latitude and the horse latitudes, the semipermanent high-pressure centers result in generally fair, clear weather with a tendency toward dryness. In the winter, temperatures hover near 50°F and summer brings temperatures into the 70's with calms existing one-fourth of the time. Below 25 degrees north latitude, in the heart of the trade wind belt, winds of 5 to 15 mph are normal. Endless bands of cumulus clouds and clear sky exist with little difference between summer and winter. Daytime temperatures range from 70°F to 80°F.

b. In the Atlantic, Pacific, and Indian Oceans between 5 degrees north latitude and 5 degrees south latitude, an equatorial trough of low pressure forms a belt where no prevailing surface winds exist and is known as the doldrums. Instead, the lack of extreme pressure gradients result in shifting winds and calms which exist as much as one-third of the time. Intense solar heating results in violent thunderstorms associated with strong squall winds. The convergence of these equatorial winds and trade winds from the intertropical front can be seen at a great distance because of towering cumulus clouds rising to 30,000 feet.

c. In the vicinity of the intertropical front, heavy convective showers are quite common. Across the Atlantic and Eastern Pacific, the front is usually north of the Equator. Over the western Pacific, west of 180-degrees longitude, the doldrum belt oscillates considerably. Areas north of the Equator receive their heavy rainfall from June to September. Areas south of the Equator receive their heaviest precipitation between December and March. The meteorological sequence described above may be interrupted by periods of extreme weather centered around low pressure.

d. Waterspouts are the marine equivalent of tornadoes attached to the base of a cumulus or cumulonimbus cloud. They are common off the Atlantic and Gulf coasts of the United States and along the coasts of Japan and China during any season. They are usually seen around noon when solor heating is the greatest. They are small in diameter (10 to 100 yards) and short in duration (10 to 15 minutes). Waterspouts generally exhibit less intensity than overland tornadoes.

e. Hurricanes and typhoons are synonyms for tropical cyclones whose maximum winds exceed 75 mph. They occur in the warm western sectors of all oceans during summer and fall. Winds may reach 170 to 230 mph. The lifespan of tropical cyclones ranges from 1 to 2 weeks. In the middle and high latitudes, extratropical cyclones contrast with tropical cyclones in several ways. There is no warm, clear eye, but rather, a cold region of heavy precipitation. Sustained winds are more moderate (70 to 80 mph). Extratropical cyclones may persist for 2 to 3 days at a fixed location.

f. All ocean currents have a profound influence on climate since the properties of the surface largely determine the properties of the various airmasses. The following are a few examples.

(1) The cold water of the Peru or Humbolt currents has a tremendous affect on the climate of Peru and Chile. The cold air that lies over the current is warmed as it reaches land, increasing its capacity to hold moisture. The warm air does not give up the moisture until it passes over the high Andes Mountains. This accounts for the dry climate of the coast of Chili and Peru and a more temperate climate toward the Equator than is usually found in the lower latitudes.

(2) Where the Labrador current contacts the warm gulf stream, fog prevails and steep temperature gradients are present. The northeast coast of North America has much colder climates than the west coast of Europe at the same latitude.

(3) The warm gulf stream current accounts for the continually warm and pleasant weather in the Caribbean Sea and the Gulf of Mexico.

(4) The winds blowing off the warm water of the Norwegian and east and west Greenland currents account for the unusually mild climates in northern Europe. At the same latitude elsewhere, the temperatures are usually much colder.

11-11. Life Forms. Life forms in the seas range from one-celled animals (protozoan) to complex aquatic mammals. The fish and aquatic mammals rule the sea and are of the most concern to anyone in a survival situation on the open seas. The majority of fishes and mammals can be used as food sources, but some must be considered as a hazard to life; such as, sharks, whales, barracudas, eels, sea snakes, rays, and jellyfish.

a. Sharks. (See figure 11-40.)

(1) Most sharks are scavengers, continuously on the move for food. If none is available, they lose interest and swim on. Even in warm oceans where most attacks

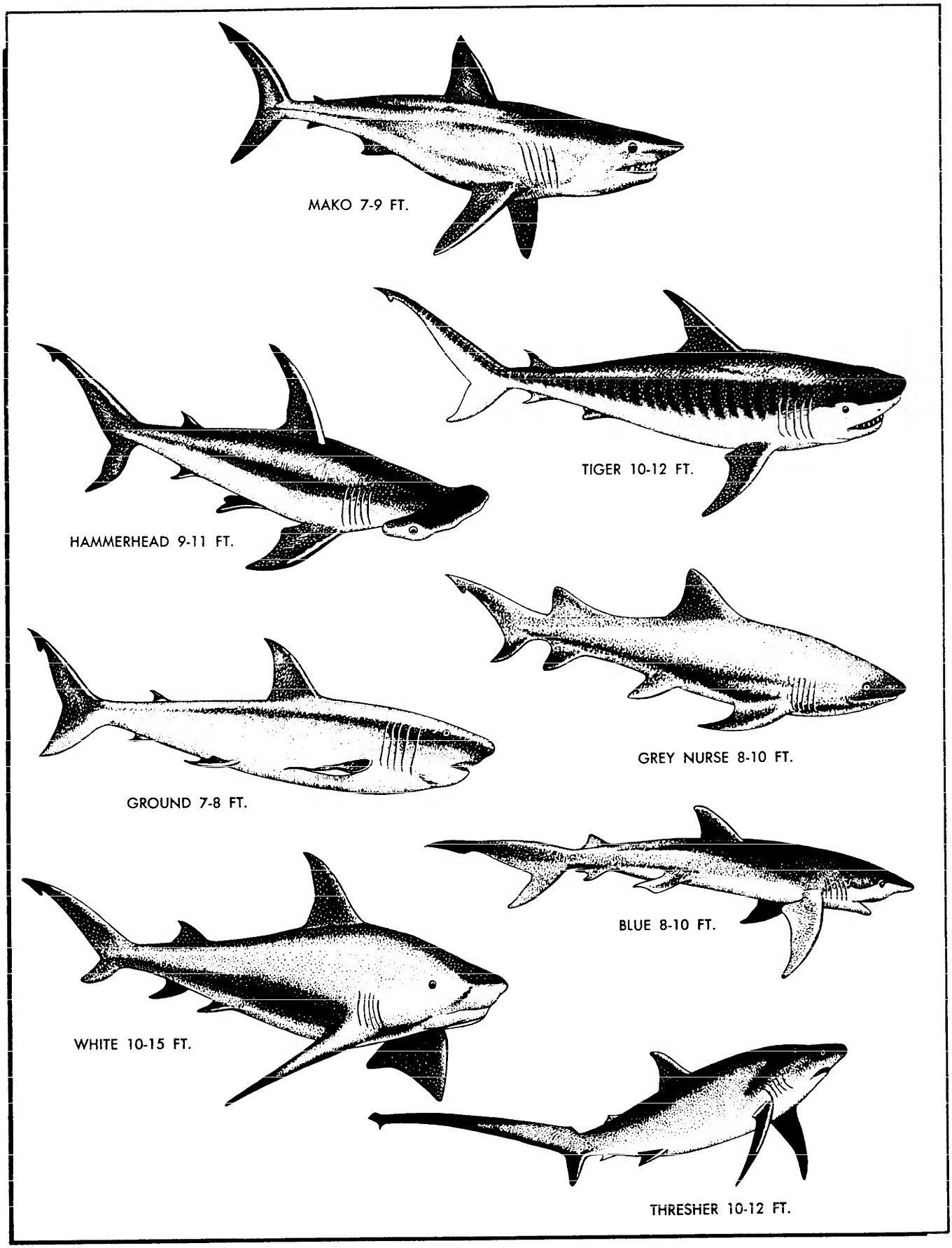


Figure 11-40. Sharks.

occur, the risk can be reduced by knowing what to do and how to do it. Sharks live in almost all oceans, seas, and in river mouths. Normally, there isn't a shark problem in areas of colder water due to the temperature of the water decreasing swim activities. Sharks vary greatly in size, but there is no close relationship between the size of a shark and the risk of attack.

(2) Hungry sharks sometimes follow fish up to the surface and into shallow waters along the shore. When sharks explore such waters, they are more likely to come in contact with people. Sharks seem to feed most actively during the night and particularly at dusk and dawn. After dark, they show an increased tendency to move toward the surface and into shore waters. Evidence indicates that a shark first locates food by smell or sound. Such things as garbage, body wastes, and blood probably stimulate the desire for food. A shark is also attracted by weak fluttery movements similar to those of a wounded fish. While a shark will investigate any large floating object as a possible food source, it probably will not attack a human unless it is hungry. Often the shark will swim away after investigating. At other times, it may approach and circle the object once or twice, or it may swim close and nudge the object with its snout. When swimming, a shark cannot stop suddenly or turn quickly in a tight circle. A shark rarely jumps out of the water to take food; however, it may grasp its prey near the surface. For this reason, people on rafts are relatively safe unless they dangle their hands, arms, feet or legs in the water.

(3) Individuals on or in the water must keep a sharp lookout for sharks. Clothing and shoes should be worn. If sharks have been noticed, survivors must be especially careful of the methods in which body wastes are eliminated and must avoid dumping blood and garbage. Vomiting, when it cannot be prevented should be done into a container or hand and thrown as far away as possible.

(a) If a group in the water is threatened or attacked by a shark, they should bunch together, form a tight circle, and face outward so an approaching shark can be seen. Ward off attack by kicking or stiff-arming the shark. Striking with the bare hand should be used only as a last resort; instead, survivors should use a hard and heavy object.

(b) Individuals should stay as quiet as possible and float to save energy. If it is necessary to swim, they should use strong, regular strokes, not frantic irregular movements.

(c) When alone, swimmers should stay away from schools of fish. If a single shark threatens at close range, the swimmer should use strong, regular swimming movements. Feinting toward the shark may scare it away.

(d) The survivor should not swim directly away from the shark, but face the shark and swim to one side, with strong rhythmic movements.

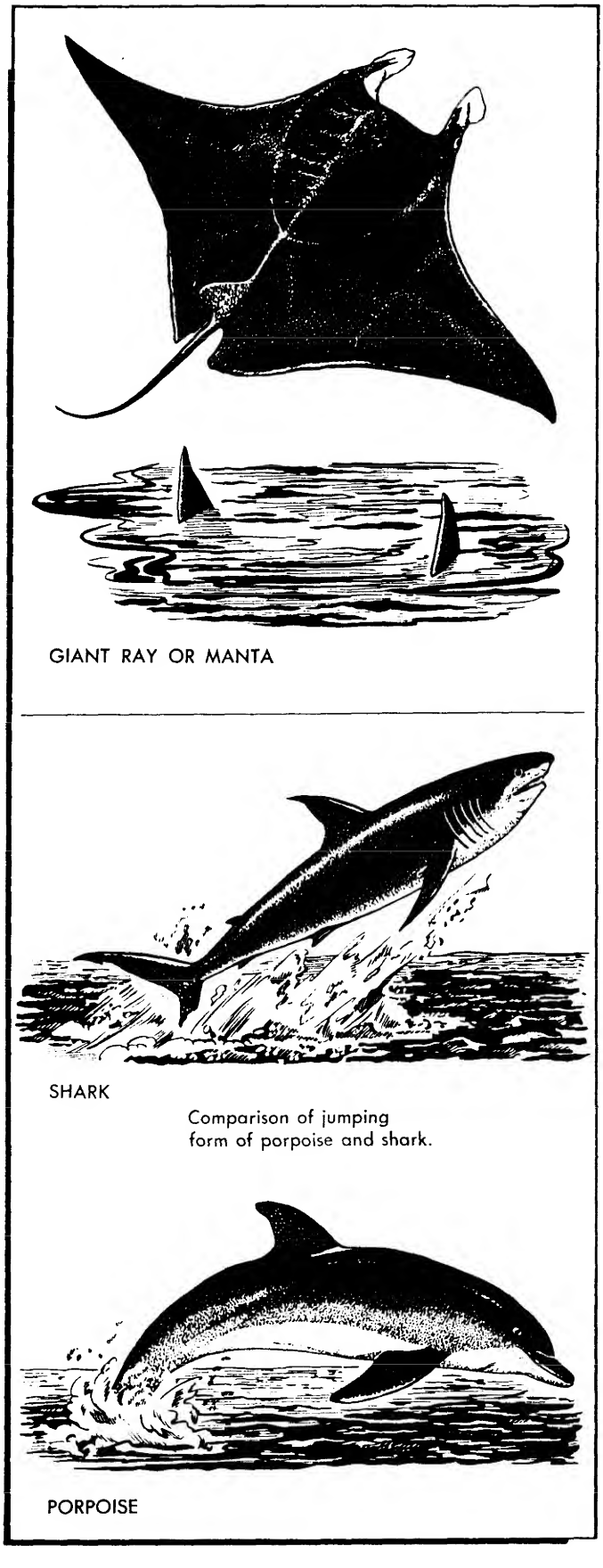


Figure 11-41. Animals Sometimes Mistaken for Sharks.

(e) If a shark threatens to attack or damage a raft, jabbing the snout or gills with an oar may discourage it. Check for sharks around and under the raft before going into the water.

(4) Other animals are sometimes mistaken for sharks.

(a) A school of porpoises or dolphins gracefully breaking the surface, blowing and grunting, may look alarming. Actually, it should be a reassuring sight, because porpoises and dolphins are enemies of sharks. Porpoises and dolphins are harmless to humans (figure 11-41).

(b) Giant rays or mantas, which also appear in tropical waters, may be mistaken for sharks. A swimming ray curls up the tips of its fins, and when seen from water level, the fins somewhat resemble the fins on the backs of two sharks swimming side by side. In deep water, all rays are harmless to swimmers; however, some are dangerous if stepped on in shallow waters (figure 11-41).

b. Grouper or Sea Bass. These fish do not constitute the same degree of hazard as sharks; however, these carnivorous fish are curious, bold, and have a never-ending appetite. Sea bass are most commonly found around rocks, caverns, old wrecks, and caves. Stay away from these areas.

c. Killer Whales. The killer whale has the reputation of being a fearless, ruthless, and ferocious creature. These fast swimmers are found in all oceans and seas, from the tropics to both polar regions. If encountered, a survivor can be assured there are others nearby since they hunt in packs of up to 40 creatures. They have been known to attack anything that swims or floats. If an initial attack is survived, get out of the water. The raft may afford some protection, but they have been known to come up under iceflows and knock other animals into the water. Stay out of the water. On thin ice, do not stand near seals, etc., as the whale may mistake the human form for a seal. However, the probability of being attacked by a killer whale is slim. If an aircrew member is attacked, it will probably be due to the fact that this intelligent whale simply mistook the person for its regular diet.

d. Barracuda. There are 20-odd species of barracuda; some are more feared in certain parts of the world than are sharks. If survivors come down in any tropical or subtropical sea, they may encounter this fish. Barracuda are attracted by anything which enters the water and they seem to be particularly curious about bright objects. Accordingly, survivors should avoid dangling dogtags or other shiny pieces of equipment in the water. Dark colored clothing is also best to wear in the water if no raft is available.

e. Moray Eels. If attacked by some species of moray eel, the survivor may have to cut off its head since some eels will retain their sharp crushing grip until dead. The knife used to do this should be very sharp since their skin is tough and difficult to cut. Their bodies are very slippery and hard to hold. A survivor is most likely to come into contact with a moray eel when poking into holes and crevices around or under coral reefs. Use caution in these areas.

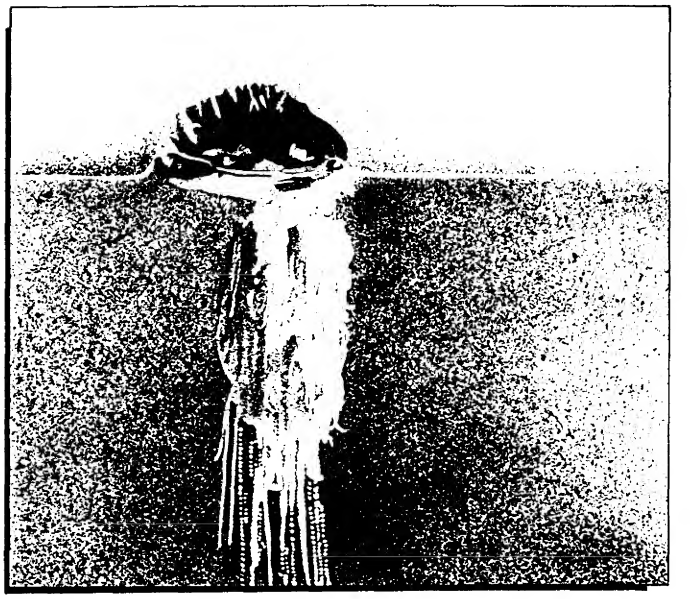


Figure 11-42. Portuguese Man-of-War.

f. Poisonous and Venomous Marine Animals (Invertebrates). There are many marine animals that have no backbone and can inflict injuries by stinging. Three major categories of invertebrates are important to the survivor.

(1) Coelenterates. This group includes jellyfish, hydroids, sea anemones, and corals. Coelenterates are all simple, many-celled organisms. They all possess tentacles equipped with stinging cells or nematocysts in addition to other technical characteristics. The family of coelenterates is divided into three major classes.

(a) Hydrozoan Class. Two of the more common members of this class are:

-1. Stinging or Fire Coral. This false coral can be found in areas of true coral reefs in warm waters.

-2. Portuguese Man-of-War or Blue Bottle. This hydroid is frequently mistaken for a true jellyfish. It is almost always found floating at the surface of the water (figure 11-42). Its stinging tentacles may extend several yards below the surface. Their float is 5 to 10 inches in length. Each tentacle may contain thousands of stinging cells. When one considers the large number of such tentacles, it is apparent that the fishing filaments of the Blue Bottle are quite a formidable venom apparatus.

(b) Anthozoa Class:

-1. Corals. Elkhorn coral and stony coral are very adaptable and have a real immunity to predators.

This helps explain why they tend to dominate reef communities. Corals are carnivores and with the use of small tentacles, capture and consume living zooplankton. Survivors should treat coral cuts by thoroughly cleaning the wound and removing any coral particles. Some coral cuts have been helped by painting them with an antiseptic solution of tincture of iodine.

-2. Sea Anemones. The sea anemone is one of the most plentiful marine creatures, with well over 1,000 species. They can be found from tide level to depths of more than 7,900 fathoms in all seas. Their size ranges from very small, (less than an inch) to over 2 feet in diameter. They eat fish, mollusks, crustaceans, and other invertebrates. Most of the stinging cells of the sea anemones are located on the outer ring of the tentacles.

(c) Scyphozoa Class—Jellyfish. There are many and varied species of jellyfish distributed throughout all seas. Their size ranges from extremely small to a diameter of 6 feet with tentacles hanging below to a depth of 100 feet. All are carnivorous. Some are transparent and glassy while others are brilliantly colored. Regardless of their size and color, they are very fragile creatures which, for the most part, depend on wind and tidal currents to help them move. Most adults can swim but this ability is weak. Whether they stay on the surface or under the surface, and to what depth, varies with each species. The stinging cells of jellyfish are located in the tentacles.

(d) Venom Apparatus of Coelenterates:

-1. All of the coelenterates have stinging cells or nemotocysts located on the tentacles. Each of these cells is like a capsule. If the survivor comes into contact with the capsule, part of it springs open and a very sharp, extremely small "thread"-type tube appears. The sharp tip of the tube penetrates the skin and the venom is injected. When coming in contact with the tentacles of any coelenterate, the survivor brushes up against literally thousands of these small stinging organs.

-2. The symptoms produced by coelenterate stings will vary according to species, where the sting is located, and the physical condition of the survivor. In general, though, the sting caused by hydroids and hydroid corals is primarily skin irritations of a local nature. Stings of the Portuguese Man-of-War may be very painful. True corals and sea anemones produce a similar reaction. Some of the sting of these organisms may be hardly noticeable, while others may cause death in 3-8 minutes. Symptoms common to all of these may vary from an immediate mild prickly or stinging sensation, like that of touching a nettle, to a burning, throbbing, shooting-type pain which may cause the survivor to become unconscious. In some cases, the pain may be localized, while in others, it may spread to the groin, armpits, or abdomen. The area in which contact was made will usually become red, followed by severe inflammation, rash, swelling, blistering, skin hemorrhages, and sometimes ulceration. In severe cases of reaction, in addition to shock, the person may experience one or more of the following: muscular cramps, lack of touch and temperature sensations, nausea, vomiting, backache, loss of speech, constriction of the throat, frothing at the mouth, delirium, paralysis, convulsions, and death. Since some of these traits appear quickly, the victim should try to get out of the water if at all possible to avoid drowning.

-3. One of the most deadly jellyfish is the sea wasp (uncommon creature which is found in tropical southern Pacific waters). This animal can cause death anywhere from 30 seconds to 3 hours after contact. Most deaths take place within 15 minutes. The pain is said to be excruciating. The sea wasp can be recognized by the long tentacles that hang down from the four corners of its squarish body.

-a. Relieve pain. Tentacles or other matter on the skin should be removed immediately. This is important because as long as this matter is on the skin, additional stinging cells may be discharged. Use clothing, seaweed, or any other available material to remove the matter. Morphine is effective in relieving pain. *DO NOT* rub the wound with anything, especially sand, as this may cause the stinging cells to be activated. *DO NOT* suck the wound.

-b. Alleviate poison effects. Suntan lotion, oil, and alcohol should be applied to the area to stop further stinging. The following local remedies have been used in various parts of the world with varying degrees of success: papain (protein destroying enzyme), sodium bicarbonate, olive oil, sugar, soap, vinegar, lemon juice, diluted ammonia solution, papaya latex, plant juices, boric acid solution, flour, baking powder, etc. (Urine—with its ammonia content—may be the only source of relief available to a survivor).

-c. Artificial respiration and cardiopulmonary resuscitation may be required. There are no known specific antidotes for most coelenterate stings; however, there is one antivenin for the sea wasp which is papain, a proteolytic enzyme in the juice of the green fruit of the papaya. Even if the survivor is in an area where the antivenin is available, it may be too late to obtain and use it. The venom acts so quickly that medical help is often too late.

-4. Jellyfish should be given a wide berth since in some species the tentacles may trail 50 feet or more from the body. After a storm in tropical areas where large numbers of jellyfish are present, the survivor may be injured by pieces of floating tentacles that have been removed from the animals during the storm. Jellyfish washed up on the beach may appear dead, but can still, in some cases, inflict painful injuries. The best prevention is to stay out of the water by getting into a raft or onto shore. If in a raft, do not let arms and legs trail over the side. The clothing (antiexposure suit) that the survivor wears should cover as much of the body as

possible. Flight clothing items currently available should provide adequate protection.

(2) Mollusks. Octopus, squid, and univalve shellfish are in this category. Mollusks make up the largest single group of biotoxic marine invertebrates of direct importance to the survivor. The phylum of mollusks is generally divided into five classes. Stinging or venomous mollusks which concern the survivor fall mainly into two categories:

(a) Gastropoda (Stomache Footers):

-1. Mollusks. These in general are unsegmented invertebrates. Sometimes their soft bodies will secrete a calcareous shell. They have a muscular foot which serves a variety of functions. Some breathe by means of a type of siphon while others use gills. Some types have jaws. In those that don't have jaws, food is obtained by a rasp-like device called a radula. In the cone shells, the radula is a barb or tooth more like a hollow, needle-like structure.

-2. Gastropods. These univalves include marine snails, slugs, as well as land and freshwater snails. It is estimated that there are over 33,000 living species of gastropods; however, only members of the genus conus are of concern to the survivor. Of these cone shells, there are over 400 species, but they will only be discussed in general terms with the emphasis placed on the more dangerous species. With few exceptions, these attractive shellfish are located in tropical or subtropical areas. All of these shells have a very highly developed venom apparatus designed for vertebrate or invertebrate creatures and are found from shallow tidal areas to depths of many hundreds of feet. The area in which the survivor may come into contact with these shellfish is in coral reefs and sandy or rubble habitat. All cone-shaped shells in these areas should be avoided. Cone shells are usually nocturnal. During the daytime, they burrow and hide in the sand, rocks, or coral; they feed at night on worms, octopus, other gastropods, and small fish. Several of these shells have caused death in humans. The venom apparatus lies within a body cavity of the animal and the animal is capable of thrusting and injecting the poison via the barb into the flesh of the victim. The cone shell is able to inflict its wound only when the head of the animal is out of the shell.

-a. Complications. The sting made by a cone shell is a puncture-type wound. The area around the wound may exhibit one or more of the following: turn blue, swelling, numbness, stinging, or burning sensation. The amount of pain will vary from person to person. Some say the pain is like a bee sting, while others find it unbearable. The numbness and tingling sensations around the site of the wound may spread rapidly, involving the whole body, especially around the lips and mouth. Complete general muscle paralysis may occur. Coma may ensue and death is usually the result of cardiac failure.

-b. Treatment. The pain comes from the injection of venom, slime, and other irritating foreign matter into the wound site. The treatment is primarily symptomatic because there is no specific treatment. Applying hot towels or soaking the affected area in hot water may relieve some of the pain. Artificial respiration may be needed.

(b) Cephalpods. This group includes the nautilis, squid, cuttlefish, and octopus. Since the octopus is the marine animal most likely to be encountered by a survivor, it is the only one that will be discussed. The head of this animal is large and contains well-developed eyes. The mouth is surrounded by eight legs equipped with many suckers. It can move rapidly by expelling water from its body cavity, though it usually glides or creeps over the bottom. Most octopuses live in water ranging from very shallow to depths of over 100 fathoms. All are carnivorous and feed on crabs, and other mollusks. Octopuses like to hide in holes or underwater caves—avoid these areas.

-1. Complications. The sharp parrot-like beak of the octopus makes two small puncture wounds into which a toxic solution or venom is injected. Pain is usually felt immediately in the form of a burning, itching, or stinging sensation. Bleeding from the wound is usually very profuse which may indicate the venom contains an anticoagulant. The area around the wound, and in some cases the entire appendage, may swell, turn red, and feel hot. There has been one report of a fatal octopus bite. This death was attributed to the blue ringed octopus (Octopus Maculosus) (figure 11-43). This small octopus is usually only 3 or 4 inches across although some may be slightly larger. Found throughout the Indo-Pacific area, this octopus is not aggressive toward humans. Because its bite is so dangerous, it should not be handled at any time. When this animal is disturbed the intensity of its blue rings varies rapidly on a light yellow or cream to brown background.

Figure 11-43. Blue Ringed Octopus.

-2. Treatment. Treat for shock, stop bleeding, clean the wound area since more venomous saliva could be in the area, and treat symptoms as they arise. There is no known cure for the venom of the Blue Ringed Octopus.

(3) Echinoderms. Sea cucumbers, starfish, and sea urchins are members of this group. Sea urchins comprise the most dangerous type of echinoderms. Sea urchins have rounded, egg-shaped, or flattened bodies. They have hard shells that carry spines. In some species, the spines are venomous and present a hazard if stepped on or handled. Some urchins are nocturnal. They all tend to be omnivorous, eating algae, mollusks, and other small organisms. They can be found in tidal pools or in areas of great depth in many parts of the world. Sea urchins are not good food sources. At certain times of the year, certain species can be poisonous.

(a) Complications. The needle-sharp points of sea urchin spines are able to penetrate the flesh easily. These spines are also very brittle and tend to break off while still attached to the wound and are very difficult to withdraw. Stepping on one of these spines produces an immediate and very intense burning sensation. The area of pain will also swell, turn red, and ache. Numbness and muscular paralysis, swelling of the face, and a change in the pulse have also been reported. Secondary infection usually sets in. While some deaths have been reported, other victims have experienced loss of speech, respiratory distress, and paralysis. The paralysis will last from 15 minutes to 6 hours.

(b) Treatment. Spines (pedicellaria) that are detached from the animal will continue to secrete venom into the wound. The spines of some species will be easily dislodged whereas others must be surgically removed. There will also be some discoloration due to a dye the animal secretes—do not be disturbed by this. Some experts say to apply grease to allow the spines to be scraped off. Others advise leaving them alone since some of the spines will dissolve in the wound within 24 to 48 hours. Still other experts say to apply citrus juice, if available, or soak the area in vinegar several times a day to dissolve them.

(c) Prevention. No sea urchin should be handled. The spines can penetrate leather and canvas with ease.

g. Venomous and Poisonous Marine Animals (Vertebrates). These fish can be divided into two general groups—fish that sting and fish that are poisonous to eat (figure 11-44).

(1) Venomous Spine Fish (Fish That Sting):

(a) Types of fish in this group are:

-1. Spiny dog fish.

-2. Stingrays. Includes whiprays, batrays, butterfly rays, cow-nosed rays, and round stingrays.

-3. Rat fish.

-4. Weever fish.

-5. Catfish.

-6. Toad fish.

-7. Scorpion fish.

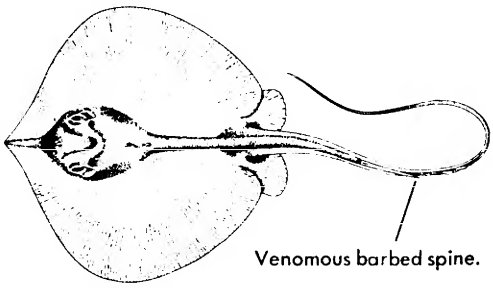
-8. Surgeon fish.

-9. Rabbit fish.

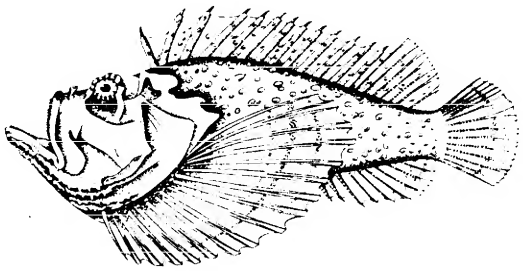
-10. Star gazers.

NOTE: For all wounds from these types of fish, aid should be directed to three areas: alleviating the pain of the sting, trying to halt the effects of the venom, and preventing infection.

(b) Certain types of these fish have up to 18 spines. The pain caused by the sting of one of these spines is so great in some species that the victim may scream and thrash about wildly. In one case, a man stung in the face by a weever fish begged for bystanders to shoot him, even after two shots of morphine sulfate. Many of these fish are bottom dwellers who will not move out of the way when being approached by humans. Instead, they will lie quietly camouflaged, put up their spines, and simply wait for the unlucky individual to step on them. Other people have been injured by them while trying to remove them from fishing nets and fishing lines. In cases where humans are stung by stingrays, the barbs on the sharp spines may cause severe lacerations as well as introduce poison. These wounds should be irrigated without delay. Puncture wounds from the fish are small and make removal of the poison a difficult process. It may be necessary to remove the barb. A procedure which is fairly successful is to make a small cut across the wound (debride) and then apply suction. Even if no incision is made, suction should be tried since it is important to remove as much of the venom as possible. The more poison removed, the better. Morphine does not relieve the pain of some of these venoms. Most doctors agree that the injured part should be soaked in hot water from 30 minutes to 1 hour. The

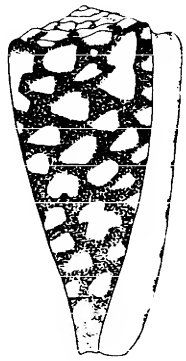


STINGRAY (Top view)



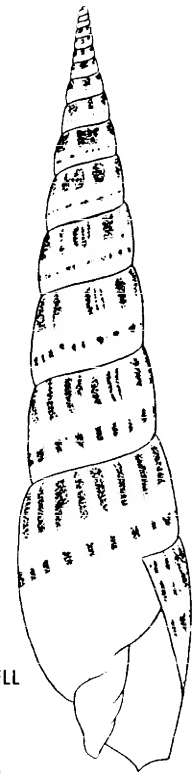
STONEFISH
(About 15 In.)

Spines are poisonous
and victims must be treated
same as for snakebite.



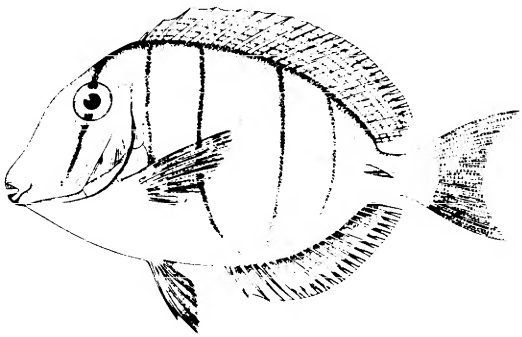
CONE SHELL

These snails bite and
can cause acute pain,
swelling, paralysis,
blindness, and possible
death in a few hours.



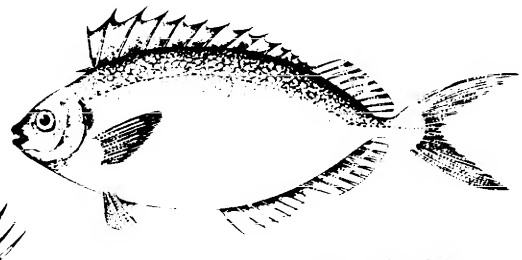
TEREBRA SHELL

B — VENOMOUS SNAILS

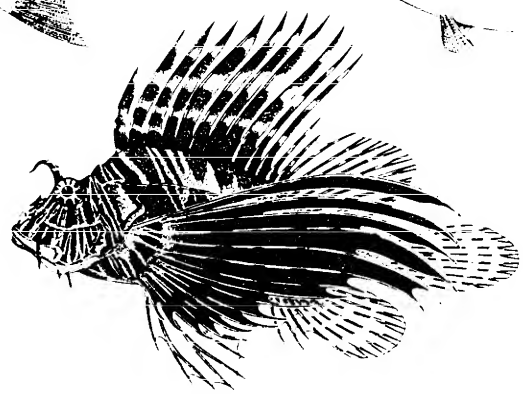


SURGEON FISH
(8-10 In.)

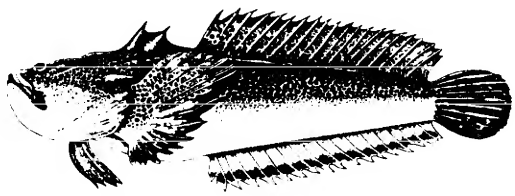
Venomous spines
and poisonous flesh.



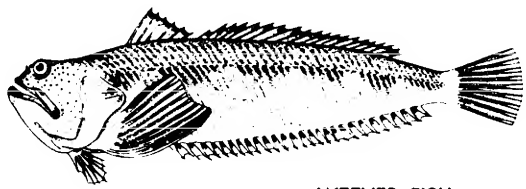
SIGANUS FISH
(4-6 In.)



ZEBRA FISH
(10-30 In.)



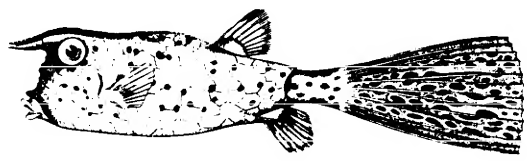
TOAD FISH
(About 1 Ft.)



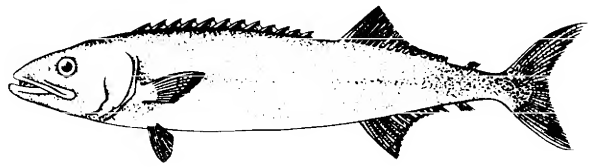
WEEVER FISH
(About 1 Ft.)

A — VENOMOUS SPINE FISH

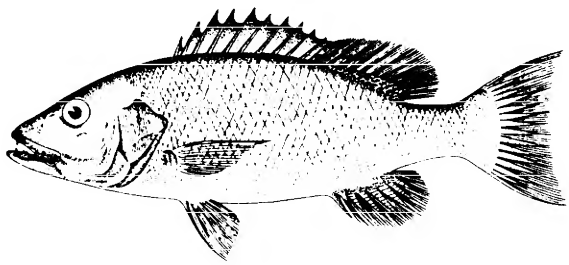
Figure 11-44. Venomous Spine Fish and Snails.



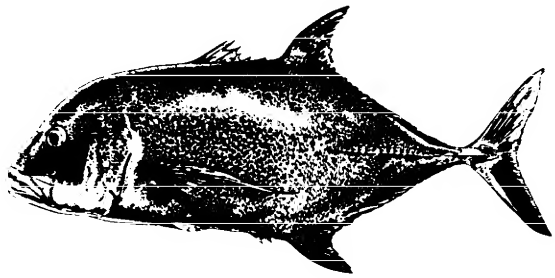
COWFISH
(6-12 In.)



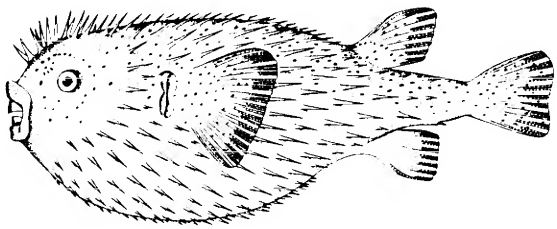
OIL FISH
(3-5 Ft.)



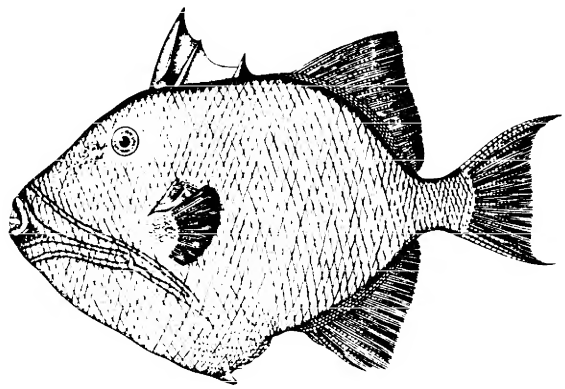
REDSNAPPER FISH
(2-3 Ft.)



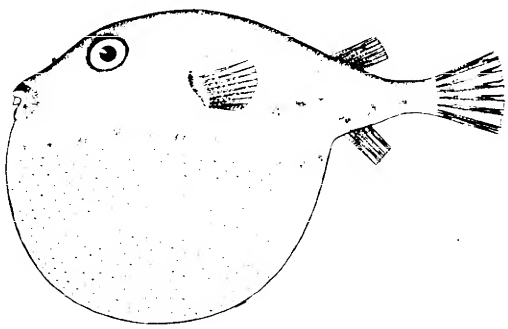
JACKFISH
(About 2 Ft.)



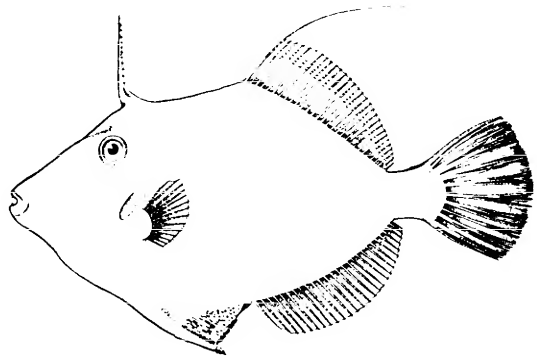
PORCUPINE FISH
(About 1 Ft.)



TRIGGER FISH
(1-2 Ft.)



PUFFER FISH
(10-15 In.)



THORNFISH
(About 1 Ft.)

Figure 11-45. Fish With Poisonous Flesh.

temperature of the water should be as hot as the patient can stand without injury. If the wound is on the face or body, hot moist cloth compresses can be used. The use of heat in this manner may weaken the effect of the poison in some cases. After soaking the wound, clean it again, if necessary. Cover the area of the wound with antiseptic and a clean sterile dressing. If antibiotics are available, it may be advisable to use them to help prevent infection. Treatment for shock is wise. Artificial respiration may be needed since some venoms may cause cardiac failure, convulsions, or respiratory distress.

(c) For fish that are poisonous to eat, see figure 11-45.

-1. There is no known way to detect a poisonous fish merely by its appearance. Fish that are poisonous in one area may be safe to eat in another. In general, bottom dwellers and feeders, especially those associated with coral reefs, should be suspect. Also, unusually large predator-type fish should be eaten with caution. The internal organs and roe of all tropical marine fish should never be eaten, as those parts contain a higher concentration of poison.

-2. Under certain conditions, where the survivor may be required to eat questionable fish, rules should be followed. A fish will be safer if it can be caught away from reefs or entrances to lagoons. Once the fish has been secured, the "marine animal edibility test" should be used. The fish should be cut into thin strips and boiled in successive changes of water for an hour or more. This may help since some, but not all, of the toxins are water soluble. Further, it should be noted, that normal cooking techniques and temperatures will not weaken or destroy poisons.

-3. If boiling is not possible, cut the meat into thin strips and soak in changes of sea water for an hour or so, squeezing the meat juices out as thoroughly as possible. A survivor should eat only a small portion of the flesh and wait 12 hours to see if any symptoms arise (if the fish will not spoil). Remember that the degree of poisoning is directly related to how much fish is eaten. If in doubt, do not eat it. The advice of native people on eating tropical marine fish may not be valid. In many instances they check edibility by first feeding fish portions to their dogs and cats.

-4. Treatment. As soon as any symptoms arise, vomiting should be induced by administering warm saltwater or the whites of eggs. If these procedures don't work, try sticking a finger down the person's throat. A laxative should also be given to the victim if one is available. The victim may have to be protected from injury during convulsions. If the victim starts to foam at the mouth and exhibits signs of respiratory distress, a cricothyroidotemy may have to be performed. Morphine may help relieve pain in some cases. If the victim complains of severe itching, cool showers may give some relief. Treat any other symptoms as they arise.

(2) Poisonous Marine Turtles:

(a) Species. There are over 265 species of marine turtles. Of these, only five have been reported as poisonous and dangerous to the survivor. Many of these species are commonly eaten, but for some unknown reason, these same turtles become extremely toxic under certain conditions. Basically, the main species to be concerned with are the green, the hawksbill, and the leatherback turtles. These turtles are found mainly in tropical and subtropical seas but can also be found in temperate waters.

(b) Origin. The origin of turtle poison is unknown but some investigators suggest it comes from the poisonous marine algae eaten by the turtles. It should be noted that a species of turtle may be safe to eat in one area but deadly in another. There is absolutely no way a survivor can distinguish between a poisonous and nonpoisonous sea turtle just by looking at it or by examining any part of it. Toxicity may occur at any time of the year; however, the most dangerous months appear to be the warmer months. The degree of freshness also has nothing to do with how poisonous the turtle is.

(c) Complications. The symptoms will vary with the amount of turtle ingested. Symptoms will develop within a few hours to a few days after eating the food. These symptoms include nausea, vomiting, diarrhea, pain, sweating, coldness in the extremities, vertigo, dry and burning lips and tongue, tightness of the chest, drooling, and difficulty in swallowing. Other victims reported a heavy feeling of the head, a white coating on the tongue, diminished reflexes, coma, and sleepiness. About 44 percent of the victims poisoned by marine turtles die.

(d) Treatment. There is no known antidote for this kind of poisoning. There is no specific treatment—treat symptomatically.

(e) Prevention. If there is the slightest suspicion about the edibility of a marine turtle, it should not be eaten, or at least the marine animal edibility test should be used. Turtle liver is especially dangerous to eat because of its high vitamin A content.

h. Birds. There are roughly 260 species of sea birds. Most of the birds travel only a few miles out to sea but the albatross ranges across the seas far from any landmasses.

i. Red Tide. Red tide is a name used to describe the reddish or brownish coloration in saltwater, resulting from tiny plants and organisms called plankton, which suddenly increase tremendously in numbers. Red tides appear in waters worldwide. In the United States, they are most common off the coasts of Florida, Texas, and southern California. Although most red tides are harmless, some may kill fish and other water creatures. Still other types of red tides do not kill sea life, but cause the shellfish feeding on them to be poisonous. Some of these creatures secrete poisons which can paralyze and kill fish, or can kill fish by using nearly all of the oxygen in

the water. Although the exact reason for the sudden increase of the plankton is unknown, there is evidence that shows favorable food, temperature, sunlight, water currents, and salt in the water will increase the population. It is not unusual for it to remain from a few hours to several months. A survivor should not eat any fish that are found dead.

Chapter 12

LOCAL PEOPLE

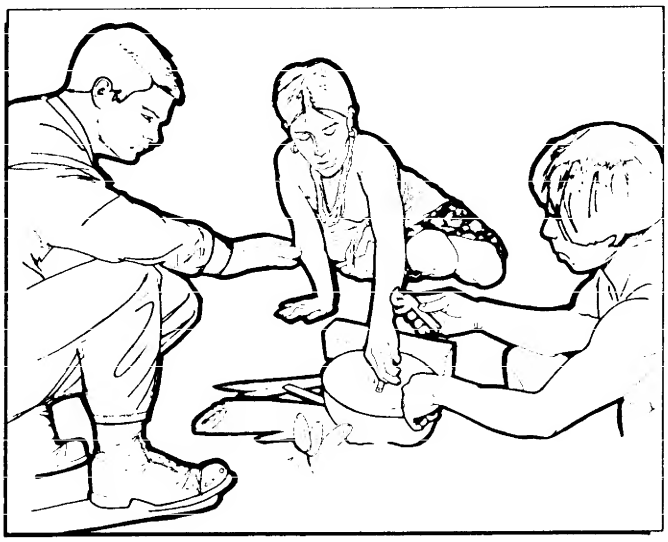


Figure 12-1. Local People.

12-1. Introduction. One evader concluded with the following advice: "My advice is, 'When in Rome, do as the Romans do!' Show interest in their country, and they will go overboard to help you!" One of the most frequently given bits of advice is to accept, respect, and adapt to the ways of the people among whom survivors find themselves. This is good advice, but there are a number of important problems involved in putting this advice into practice (figure 12-1).

12-2. Contact With People. The survivor must give serious consideration to people. Are they people with a primitive culture? Are they farmers, fishermen, friendly people, or enemies? To the survivor, "cross-cultural contact" can vary quite radically in scope. It could mean interpersonal relationships with people of an extremely different (primative) culture, or contacts with people who are culturally modern by our standards. A culture is identified by standards of behavior that are considered proper and acceptable for the members and may or may not conform to our idea of propriety. Regardless of who these people are, the survivor can expect they will have different laws, social and economic values, and political and religious beliefs.

a. People will be friendly, unfriendly, or choose to ignore the survivor. Their attitude may be unknown. If the people are known to be friendly, the survivor must make every attempt to keep them that way by being courteous and respecting the religion, politics, social customs, habits, and all other aspects of their culture. If the people are known to be enemies or are unknowns, the survivor should make every effort to avoid any contact and leave no sign of presence. Therefore, a basic knowledge of the daily habits of the local people can be extremely important in this attempt. An exception might be, if after careful and covert observation, it is determined an unknown people are friendly, contact might be made if assistance is absolutely necessary.

b. Generally, there is little to fear and everything to gain from thoughtful contact with the local peoples of friendly or neutral countries. Familiarity with local customs, displaying common decency, and most importantly, showing respect for their customs should help a survivor avoid trouble and possibly gain needed assistance. To make contact, a survivor should wait until only one person is near and, if possible, let that person make the initial approach. Most people will be willing to help a survivor who appears to be in need; however, political attitudes and training or propaganda efforts can change the attitudes of otherwise friendly people. Conversely, in nominally unfriendly countries, many people, particularly in remote areas, may feel abused or ignored by their politicians, and may be more friendly toward outsiders.

c. The key to successful contact with local peoples is to be friendly, courteous, and patient. Displaying fear, displaying weapons, and making sudden or threatening movements can cause a local person to fear a survivor which can, in turn, prompt a hostile response. When attempting contact, smile frequently. Many local peoples may be shy and seem unapproachable or they may ignore the survivor. Approach them slowly and don't rush matters.

12-3. Survivor's Behavior:

a. Salt, tobacco, silver money, and similar items should be used discreetly in trade. Paper money is well known worldwide. Don't overpay; it may lead later to embarrassment and even danger. Treat people with respect and do not laugh at or bully them.

b. Sign language or acting out needs or questions can be very effective. Many people are accustomed to it and communicate using nonverbal sign language. Aircrew members should learn a few words and phrases of the local language in and around their area of operations. Attempting to speak someone's language is an excellent way to show respect for their culture. Since English is widely used, some of the local people may understand a few words of English.

c. Certain areas may be taboo. They range from religious or sacred places to diseased or danger areas. In some areas, certain animals must not be killed. A survi-

vor must learn what the rules are and follow them. The survivor must be observant and learn as much as possible. This will not only help in strengthening relations, but new knowledge and skills may be very important later. The downed aircrew member should seek advice on local hazards and find out from friendly people where there are hostile people. Keep in mind though, that frequently, people, as in our culture, insist others are hostile because they also do not understand different cultures and distant peoples. The people that generally can be trusted, in their opinion, are their immediate neighbors—much the same as in our own neighborhood. Local people, like ourselves, suffer from diseases which are contagious. The survivor should build a separate dwelling, if possible, and avoid physical contact without seeming to do so. Personal preparation of food and drink is desirable if it can be done without giving offense. Frequently, the use of "personal or religious custom" as an explanation for isolationist behavior will be accepted by the local people.

d. Trading or barter is common in more primitive societies. Hard coin is usually good, whether for its exchange value or as jewelry or trinkets. In isolated places, matches, tobacco, salt, razor blades, empty containers, or cloth may be worth more than any form of money.

e. The survivor must be very cautious when touching people. Many people consider "touching" taboo and such actions may be dangerous. Sexual contact should be avoided.

f. Hospitality among some people is such a strong cultural trait they may seriously reduce their own supplies to make certain a stranger or visitor is fed. What is offered should be accepted and shared equally with all present. The survivor should eat in the same way they eat and, most importantly, attempt to eat all that is offered. If any promises are made, they must be kept. Personal property and local customs and manners, even if they seem odd, must be respected. Some kind of payment for food, supplies, etc., should be made.

g. Privacy must be respected and a survivor should not enter a house unless invited.

12-4. Changing Political Allegiance. In today's world of fast-paced international politics and "shuttle diplomacy," political attitudes and commitments within nations are subject to rapid change. The population of many countries, especially politically hostile countries, must not be considered friendly just because they do not demonstrate open hostility. Unless briefed to the contrary, avoid all contact with such people.

Part Five

PERSONAL PROTECTION

Chapter 13

PROPER BODY TEMPERATURE

13-1. Introduction. In a survival situation the two key requirements for personal protection are maintenance of proper body temperature and prevention of injury. The means for providing personal protection are many and varied. They include the following general categories: clothing, shelter, equipment, and fire. These individual items are not necessary for survival in every situation; however, all four will be essential in some

WIND SPEED		COOLING POWER OF WIND EXPRESSED AS "EQUIVALENT CHILL TEMPERATURE"																			
KNOTS	MPH	TEMPERATURE (°F)																			
Calm	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-60
		EQUIVALENT CHILL TEMPERATURE																				
3 - 6	5	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-65	-70
7 - 10	10	30	20	15	10	5	0	-10	-15	-20	-25	-35	-40	-45	-50	-60	-65	-70	-75	-80	-90	-95
11 - 15	15	25	15	10	0	-5	-10	-20	-25	-30	-40	-45	-50	-60	-65	-70	-80	-85	-90	-100	-105	-110
16 - 19	20	20	10	5	0	-10	-15	-25	-30	-35	-45	-50	-60	-65	-75	-80	-85	-95	-100	-110	-115	-120
20 - 23	25	15	10	0	-5	-15	-20	-30	-35	-45	-50	-60	-65	-75	-80	-90	-95	-105	-110	-120	-125	-135
24 - 28	30	10	5	0	-10	-20	-25	-30	-40	-50	-55	-65	-70	-80	-85	-95	-100	-110	-115	-125	-130	-140
29 - 32	35	10	5	-5	-10	-20	-30	-35	-40	-50	-60	-65	-75	-80	-90	-100	-105	-115	-120	-130	-135	-145
33 - 36	40	10	0	-5	-15	-20	-30	-35	-45	-55	-60	-70	-75	-85	-95	-100	-110	-115	-125	-130	-140	-150

WINDS ABOVE 40 HAVE LITTLE ADDITIONAL EFFECT.

LITTLE DANGER

INCREASING DANGER (Flesh may freeze within 1 min)

GREAT DANGER (Flesh may freeze within 30 seconds)

DANGER OF FREEZING EXPOSED FLESH FOR PROPERLY CLOTHED PERSONS

INSTRUCTIONS

MEASURE LOCAL TEMPERATURE AND WIND SPEED IF POSSIBLE; IF NOT, ESTIMATE. ENTER TABLE AT CLOSEST 5°F INTERVAL ALONG THE TOP AND WITH APPROPRIATE WIND SPEED ALONG LEFT SIDE INTERSECTION GIVES APPROXIMATE EQUIVALENT CHILL TEMPERATURE THAT IS, THE TEMPERATURE THAT WOULD CAUSE THE SAME RATE OF COOLING UNDER CALM CONDITIONS.

NOTES

WIND

1. THIS TABLE WAS CONSTRUCTED USING MILES PER HOUR (MPH). HOWEVER, A SCALE GIVING THE EQUIVALENT RANGE IN KNOTS HAS BEEN INCLUDED ON THE CHART TO FACILITATE ITS USE WITH EITHER UNIT.
2. WIND MAY BE CALM BUT FREEZING DANGER GREAT IF PERSON IS EXPOSED IN MOVING VEHICLE, UNDER HELICOPTER ROTORS, IN PROPELLOR BLAST, ETC. IT IS THE RATE OF RELATIVE AIR MOVEMENTS THAT COUNTS AND THE COOLING EFFECT IS THE SAME WHETHER YOU ARE MOVING THROUGH THE AIR OR IT IS BLOWING PAST YOU.
3. EFFECT OF WIND WILL BE LESS IF PERSON HAS EVEN SLIGHT PROTECTION FOR EXPOSED PARTS. LIGHT GLOVES ON HANDS, PARKA HOOD SHIELDING FACE, ETC.

ACTIVITY DANGER IS LESS IF SUBJECT IS ACTIVE. A PERSON PRODUCES ABOUT 100 WATTS (341 BTUs) OF HEAT STANDING STILL BUT UP TO 1000 WATTS (3413 BTUs) IN VIGOROUS ACTIVITY LIKE CROSS-COUNTRY SKIING.

PROPER USE OF CLOTHING AND ADEQUATE DIET ARE BOTH IMPORTANT.

COMMON SENSE THERE IS NO SUBSTITUTE FOR IT. THE TABLE SERVES ONLY AS A GUIDE TO THE COOLING EFFECT OF THE WIND ON BARE FLESH WHEN THE PERSON IS FIRST EXPOSED. GENERAL BODY COOLING AND MANY OTHER FACTORS AFFECT THE RISK OF FREEZING INJURY.

Figure 13-1. Windchill Chart.

environments. In this part of the regulation, the conditions which affect the body temperature, the physical principles of heat transfer, and the methods of coping with these conditions will be covered.

13-2. Body Temperature. The body functions best when core temperatures range from 96°F to 102°F. Preventing too much heat loss or gain should be a primary concern for survivors. Factors causing changes in body core temperature (excluding illness) are the climatic conditions of temperature, wind, and moisture.

a. Temperature. As a general rule, exposure to extreme temperatures can result in substantial decreases in physical efficiency. In the worst case, incapacitation and death can result.

b. Wind. Wind increases the chill effect (figure 13-1), causes dissipation of heat, and accelerates loss of body moisture.

c. Moisture — Precipitation, Ground Moisture, or Immersion. Water provides an extremely effective way to transfer heat to and from the body. When a person is hot, the whole body may be immersed in a stream or other body of water to be cooled. On the other hand, in the winter, a hot bath can be used to warm the body. When water is around the body, it tends to bring the "body" to the temperature of the liquid. An example is when a hand is burned and then placed in cold water to dissipate the heat. One way to lower body temperature is by applying water to clothing and exposing the clothed body to the wind. This action causes the heat to leave the body 25 times faster than when wearing dry clothing. This rapid heat transfer is the reason survivors must always guard against getting wet in cold environments. Consider the result of a body totally submerged in water at a temperature of 50°F and determine how long a person could survive (figures 13-2 and 13-3).

13-3. Heat Transfer. There are five ways body heat can be transferred. They are radiation, conduction, convection, evaporation, and respiration.

a. Radiation. Radiation is the primary cause of heat loss. It is defined as the transfer of heat waves from the body to the environment and (or) from the environment back to the body. For example, at a temperature of 50°F, 50 percent of the body's total heat loss can occur through an exposed head and neck. As the temperature drops, the situation gets worse. At 5°F, the loss can be 75 percent under the same circumstances. Not only can heat be lost from the head, but also from the other extremities of the body. The hands and feet radiate heat at a phenomenal rate due to the large number of capillaries present at the surface of the skin. These three areas

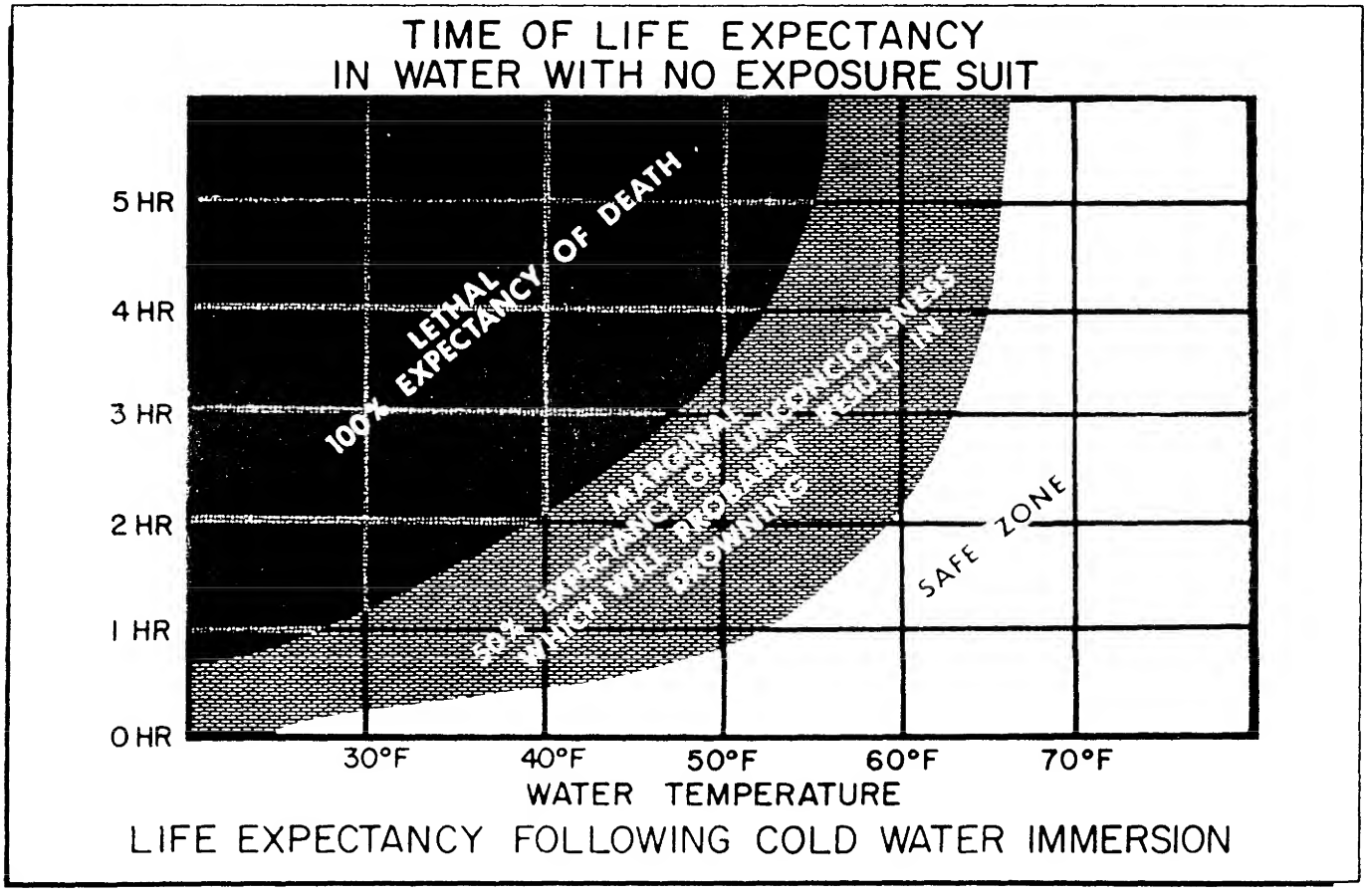


Figure 13-2. Life Expectancy Following Cold-Water Immersion.

of the body must be given particular attention during all periods of exposure to temperature extremes.

b. Conduction:

(1) Conduction is defined as the movement of heat from one molecule to another molecule within a solid

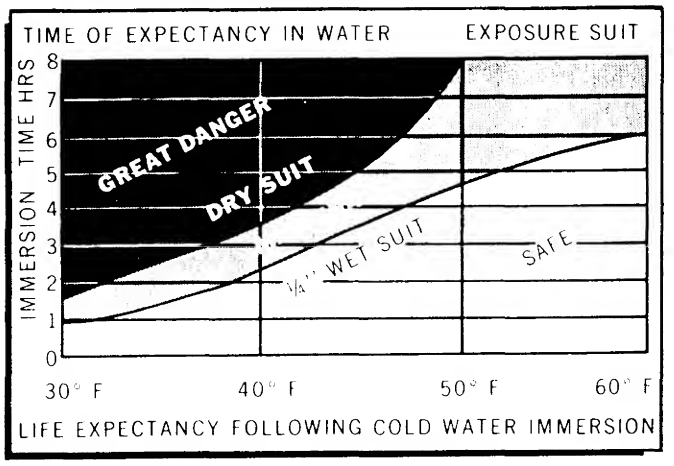


Figure 13-3. Life Expectancy Following Cold-Water Immersion (Exposure Suit.)

object. Extreme examples of how heat is lost and gained quickly are deep frostbite and third-degree burns, both gained from touching the same piece of metal at opposite extremes of cold and heat. Heat is also lost from the body in this manner by touching objects in the cold with bare hands, by sitting on a cold log, or by kneeling on snow to build a shelter. These are practices which survivors should avoid since they can lead to overchilling the body.

(2) Especially dangerous is the handling of liquid fuel at low temperatures. Unlike water which freezes at 32°F, fuel exposed to the outside temperatures will reach the same temperature as the air. The temperature of the fuel may be 10°F to 30°F below zero or colder. Spilling the fluid on exposed skin will cause instant frostbite, not only from the conduction of heat by the cold fluid, but by the further cooling effects of rapid evaporation of the liquid as it hits the skin.

c. Convection. Heat movement by means of air or wind to or from an object or body is known as convection. The human body is always warming a thin layer of air next to the skin by radiation and conduction. The temperature of this layer of air is nearly equal to that of the skin. The body stays warm when this layer of warm air remains close to the body. However, when this warm layer of air is removed by convection, the body cools down. A major function of clothing is to keep the warm layer of air close to the body; however, by removing or disturbing this warm air layer, wind can reduce body temperature. Therefore, wind can provide beneficial cooling in dry, hot conditions, or be a hazard in cold, wet conditions.

d. Evaporation. Evaporation is a process by which liquid changes into vapor, and during this process, heat within the liquid escapes to the environment. An example of this process is how a "desert water bag" works on the front of a jeep while driving in the hot desert. The wind created by the jeep helps to accelerate evaporation and causes the water in the bag to be cooled. The body also uses this method to regulate core temperature when it perspires and air circulates around the body. The evaporation method works any time the body perspires regardless of the climate. For this reason, it is essential that people wear fabrics that "breathe" in cold climates. If water vapor cannot evaporate through the clothing, it will condense, freeze, and reduce the insulation value of the clothing and cause the body temperature to go down.

e. Respiration. The respiration of air in the lungs is also a way of transferring heat. It works on the combined processes of convection, evaporation, and radiation. When breathing, the air inhaled is rarely the same temperature as the lungs. Consequently, heat is either inhaled or expelled with each breath. A person's breath can be seen in the cold as heat is lost to the outside. Because this method is so efficient at transferring heat, warm, moist oxygen is used to treat hypothermia patients in a clinical environment. Understanding how heat is transferred and the methods by which that transfer can be controlled can help survivors keep the body's core temperature in the 96°F to 102°F range. (See figure 13-4.)

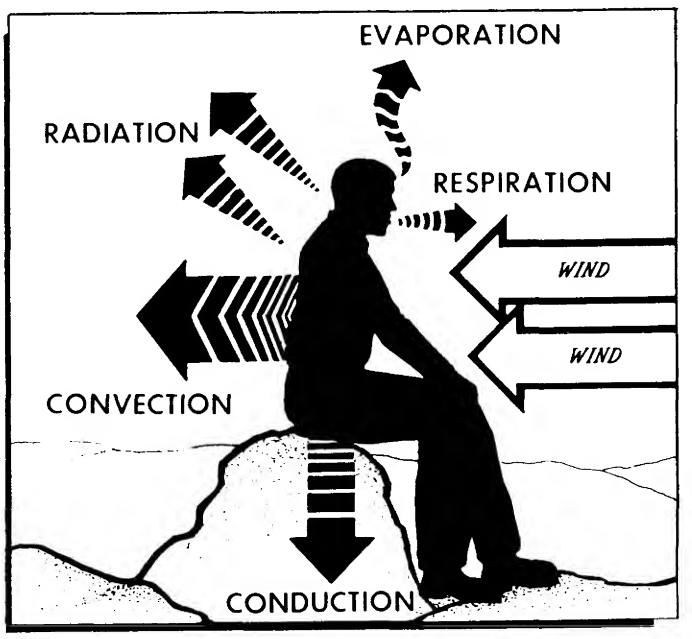


Figure 13-4. Heat Transfer.

Chapter 14

CLOTHING

14-1. Introduction. Every time people go outside they probably neglect to think about one of the most important survival-oriented assets—clothing. Clothing is often taken for granted; people tend to neglect those things which should be the most familiar to them. Clothing is an important asset to survivors and is the most immediate form of shelter. Clothing is important in staying alive, especially if food, water, shelter, and fire are limited or unobtainable. This is especially true in the first stages of an emergency situation because survivors must work to satisfy other needs. If survivors are not properly clothed, they may not survive long enough to build a fire or shelter, to find food, or to be rescued.

14-2. Protection:

a. People have worn clothing for protection since they first put on animal skins, feathers, or other coverings. In most parts of the world, people need clothing for protection from harsh climates. In snow or ice climates, people wear clothing made of fur, wool, or closely woven fabrics. They also wear warm footwear.

b. In dry climates, people wear clothing made of lightweight materials, such as cotton or linen, which have an open weave. These materials absorb perspiration and allow air to circulate around the body. People in dry climates sometimes wear white or light-colored clothes to reflect the Sun's rays. They may also wear sandals, which are cooler and more comfortable than shoes. To protect the head and neck, people wear hats as sunshades.

c. Clothing also provides protection from physical injuries caused by vegetation, terrain features, and animal life which may cause bites, stings, and cuts.

14-3. Clothing Materials:

a. Clothing is made from a variety of materials such as nylon, wool, cotton, etc. The type of material used has a significant effect on protection. Potential survivors must be aware of both the environmental conditions and the effectiveness of these different materials in order to select the best type of clothing for a particular region.

b. Clothing materials include many natural and synthetic fibers. As material is woven together, a "dead air" space is created between the material fibers. When two or three layers of material are worn, a layer of air is trapped between each layer of material creating another layer of "dead air" or insulation. The ability of these different fibers to hold "dead air" is responsible for differing insulation values.

14-4. Natural Materials. They include fur, leather, and cloth made from plant and animal fibers.

a. Fur and leather are made into some of the warmest and most durable clothing. Fur is used mainly for coats and coat linings. Leather has to be treated to make it soft and flexible and to prevent it from rotting.

b. Wool is somewhat different because it contains natural lanolin oils. Although wool is somewhat absorbent, it retains most of its insulating qualities when wet.

c. Cotton is a common plant fiber widely used to manufacture clothing. It absorbs moisture quickly and, with heat radiated from the body, will allow the moisture to pass away from the body. It does not offer much insulation when wet. It's used as an inner layer against the skin and as an outer layer with insulation (for example, wool, Dacron pile, synthetic batting) sandwiched between. The cotton protects the insulation and, therefore, provides warmth.

14-5. Synthetic Materials. Clothing manufacturers are using more and more of these materials. Many synthetic materials are stronger, more shrink-resistant, and less expensive than natural materials. Most synthetic fibers are derived from petroleum in the form of long fibers which consist of different lengths, diameters, and strengths, and sometimes have hollow cores. These fibers, woven into materials such as nylon, Dacron, and polyester, make very strong long-lasting clothing, tarps, tents, etc. Some fibers are spun into a batting type material with air space between the fibers, providing excellent insulation used inside clothing.

a. Many fabrics are blends of natural and synthetic fibers. For example, fabrics could be a mixture of cotton and polyester or wool and nylon. Nylon covered with rubber is durable and waterproof but is also heavy. There are other coverings on nylon which are waterproof but somewhat lighter and less durable. However, most coated nylon has one drawback — it will not allow for the evaporation of perspiration. Therefore, individuals may have to change the design of the garment to permit adequate ventilation (for example, wearing the garment partially unzipped).

b. Synthetic fibers are generally lighter in weight than most natural materials and have much the same insulating qualities. They work well when partially wet and dry out easily; however, they generally do not compress as well as down.

14-6. Types of Insulation:

a. Natural:

(1) Down is the soft plumage found between the skin and the contour feathers of birds. Ducks and geese are good sources for down. If used as insulation in clothing, remember that down will absorb moisture (either precipitation or perspiration) quite readily. Because of

the light weight and compressibility of down, it has wide application in cold-weather clothing and equipment. It is one of the warmest natural materials available when kept clean and dry. It provides excellent protection in cold environments; however, if the down gets wet it tends to get lumpy and loses its insulating value.

(2) Cattail plants have a worldwide distribution, with the exception of the forested regions of the far north. The cattail is a marshland plant found along lakes, ponds, and the backwaters of rivers. The fuzz on the tops of the stalks forms dead-air spaces and makes a good down-like insulation when placed between two pieces of material.

(3) Leaves from deciduous trees (those that lose their leaves each autumn) also make good insulation. To create dead-air space, leaves should be placed between two layers of material.

(4) Grasses, mosses, and other natural materials can also be used as insulation when placed between two pieces of material.

b. Synthetic:

(1) Synthetic filaments such as polyesters and acrylics absorb very little water and dry quickly. Spun synthetic filament is lighter then an equal thickness of wool and unlike down does not collapse when wet, it is also an excellent replacement for down in clothing.

(2) The nylon material in a parachute insulates well if used in the layer system because of the dead-air space. Survivors must use caution when using the parachute in cold climates. Nylon may become "cold soaked;" that is, the nylon will take on the temperature of the surrounding air. People have been known to receive frostbite when placing cold nylon against bare skin.

14-7. Insulation Measurement:

a. The next area to be considered is how well these fibers insulate from the heat or cold. The most scientific way to consider the insulating value of these fibers is to use an established criterion. The commonly accepted measurement used is a comfort level of clothing, called a "CLo" factor.

b. The CLo factor is defined as the amount of insulation which maintains normal skin temperature when the outside ambient air temperature is 70°F with a light breeze. However, the CLo factor alone is not sufficient to determine the amount of clothing required. Such variables as metabolic rate, wind conditions, and the physical makeup of the individual must be considered.

c. The body's rate of burning or metabolizing food and to produce heat varies among individuals. Therefore, some may need more insulation than others even though food intake is equal, and consequently the required CLo value must be increased. Physical activity also causes an increase in the metabolic rate and the rate of blood circulation through the body. When a person is physically active, less clothing or insulation is needed than when standing still or sitting. The effect of the wind, as shown on the windchill chart, must be considered (figure 13-1). When the combination of temperature and wind drops the chill factor to minus 100°F or lower, the prescribed CLo for protecting the body may be inapplicable (over a long period of time) without relief from the wind. For example, when the temperature is minus 60°F, the wind is blowing 60 to 70 miles per hour, and the resultant chill factor exceeds minus 150°F, clothing alone is inadequate to sustain life. Shelter is essential.

d. The physical build of a person also affects the amount of heat and cold that can be endured. For example, a very thin person will not be able to endure as low a temperature as one who has a layer of fat below the skin. Conversely, heavy people will not be able to endure extreme heat as effectively as thinner people.

e. In the Air Force clothing inventory, there are many items which fulfill the need for insulating the body. They are made of the different fibers previously mentioned, and when worn in layers, provide varying degrees of insulative CLo value. The following average zone temperature chart is a guide in determining the best combination of clothing to wear.

TEMPERATURE RANGE	CLo REQUIRED
86 to 68°F	1 - Lightweight
68 to 50°F	2 - Intermediate Weight
50 to 32°F	3 - Intermediate Weight
32 to 14°F	3.5 - Heavyweight
14 to -4°F	4.0 - Heavyweight
-4 to -40°F	4.0 - Heavyweight

The amount of CLo value per layer of fabric is determined by the loft (distance between the inner and outer surfaces) and the amount of dead air held within the fabric. Some examples of the CLo factors and some items of clothing are:

LAYERS:	1 - Aramid underwear (1 layer)	0.6 CLo
	2 - Aramid underwear (2 layers)	1.5 CLo
	3 - Quilted liners	1.9 CLo
	4 - Nomex coveralls	.6 CLo
	5 - Winter coveralls	1.2 CLo
	6 - Nomex jacket	1.9 CLo

This total amount of insulation should keep the average person warm at a low temperature. When comparing items one and two in the above example, it shows when doubling the layer of underwear, the CLo value more than doubles. This is true not only on the number one item but between all layers of any clothing system. Therefore, one gains added protection by using several very thin layers of insulation rather than two thick lay-

ers. The air held between these thin layers increases the insulation value.

f. The use of many thin layers also provides (through removal of desired number of layers) the ability to closely regulate the amount of heat retained inside the clothing. The ability to regulate body temperature helps to alleviate the problem of overheating and sweating, and preserves the effectiveness of the insulation.

g. The principle of using many thin layers of clothing can also be applied to the "sleeping system" (sleeping bag, liner, and bed). This system uses many layers of synthetic material, one inside the other, to form the amount of dead air needed to keep warm. To improve this system, a survivor should wear clean and dry clothing in layers (the layer system) in cold climates. While discussing the layer system, it is important to define the "COLDER" principle. This acronym is used to aid in remembering how to use and take care of clothing.

C - Keep clothing *C*lean.
O - Avoid *O*verheating.
L - Wear clothing *L*oose and in *L*ayers.
D - Keep clothing *D*ry.
E - *E*xamine clothing for defects or wear.
R - Keep clothing *R*epaired.

(1) Clean. Dirt and other materials inside fabrics will cause the insulation to be ineffective, abrade and cut the fibers which make up the fabric, and cause holes. Washing clothing in the field may be impractical; therefore, survivors should concentrate on using proper techniques to prevent soiling clothing.

(2) Overheating. Clothing best serves the purpose of preserving body heat when worn in layers as follows: absorbent material next to the body, insulating layers, and outer garments to protect against wind and rain. Because of the rapid change in temperature, wind, and physical exertion, garments should allow donning and removal quickly and easily. Ventilation is essential when working because enclosing the body in an airtight layer system results in perspiration which wets clothing, thus reducing its insulating qualities.

(3) Loose. Garments should be loose fitting to avoid reducing blood circulation and restricting body movement. Additionally, the garment should overhang the waist, wrists, ankles, and neck to reduce body heat loss.

(4) Dry. Keep clothing dry since a small amount of moisture in the insulation fibers will cause heat losses up to 25 times faster than dry clothing. Internally produced moisture is as damaging as is externally dampened clothing. The outer layer should protect the inner layers from moisture as well as from abrasion of fibers; for example, wool rubbing on logs or rocks, etc. The outer shell keeps dirt and other contaminants out of the clothing. Clothing can be dried in many ways. Fires are often used; however, take care to avoid burning the items. The "bare hand" test is very effective. Place one hand near the fire in the approximate place the wet items will be and count to three slowly. If this can be done without feeling excessive heat, it should be safe to dry items there. Never leave any item unattended while it is drying. Leather boots, gloves, and mitten shells require extreme care to prevent shrinkage, stiffening, and cracking. The best way to dry boots is upright beside the fire (not upside down on sticks because the moisture does not escape the boot) or simply walk them dry in the milder climates. The Sun and wind can be used to dry clothing with little supervision except for checking occasionally on the incoming weather and to make sure the article is secure. Freeze-drying is used in subzero temperatures with great success. Survivors let water freeze on or inside the item and then shake, bend, or beat it to cause the ice particles to fall free from the material. Tightly woven materials work better with this method than do open fibers.

(5) Examine. All clothing items should be inspected regularly for signs of damage or soil.

(6) Repair. Eskimos set an excellent example in the meticulous care they provide for their clothing. When damage is detected, immediately repair it.

h. The neck, head, hands, armpits, groin, and feet lose more heat than other parts of the body and require greater protection. Work with infrared film shows tremendous heat loss in those areas when not properly clothed. Survivors in a cold environment are in a real emergency situation without proper clothing. Figure 14-1 shows some examples of how military clothing works to hold body heat.

i. Models wearing samples of aircrew attire appear as spectral figures in a thermogram, an image revealing differences in infrared heat radiated from their clothing and exposed skin. White is warmest; red, yellow, green, blue, and magenta form a declining temperature scale spanning about 15 degrees; while black represents all lower temperatures. Almost the entire scale is seen on the model in boxer shorts. Warm, white spots appear on the underarm and neck. Only the shorts block radiation from the groin. Temperatures cool along the arm to dark blue fingertips far from the heat-producing torso. The addition of the next layer of clothing (Aramid long underwear) prevents heat loss except where it is tight against the body. As more layers are added, it is easy to see the areas of greatest concern are the head, hands, and feet. These areas are difficult for crewmembers to properly insulate while flying an aircraft. Mittens are ineffective due to the degraded manual dexterity. Likewise, it is difficult to feel the rudder pedal action while wearing bulky warm boots. These problems require inclusion of warm hats, mittens, and footgear (mukluk type) in survival kits during cold weather operation. Research has shown when a CLo value of 10 is used to insulate the head, hands, and feet and the rest of the body is only protected by one CLo, the average individual can be exposed to low temperatures (-10°F) comfortably for a reasonable period of time (30 to 40 minutes). When the amount of CLo value placed on the

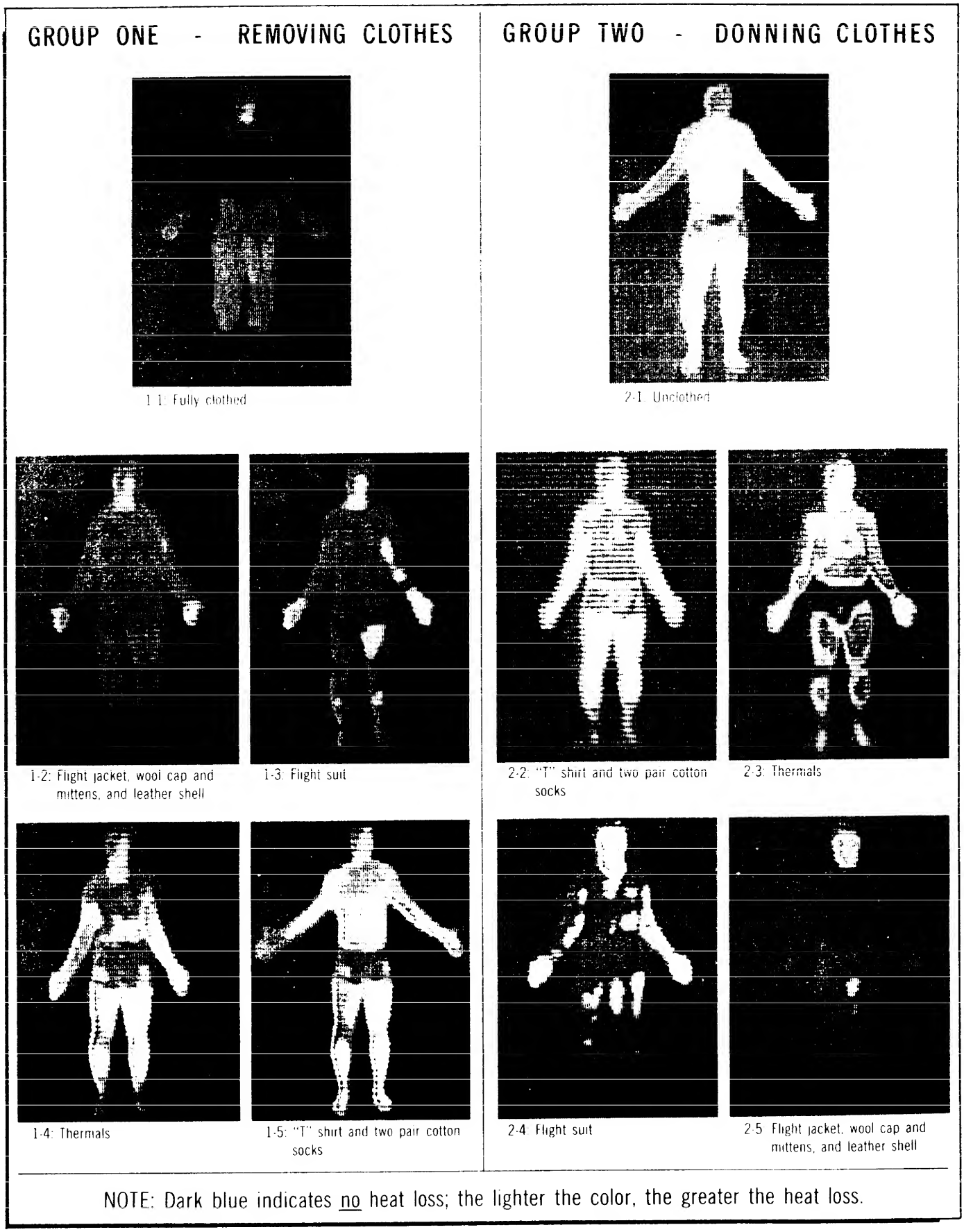


Figure 14-1. Thermogram of Body Heat Loss.

individual is reversed, the amount of time a survivor can spend in cold weather is greatly reduced due to the heat loss from their extremities. This same principle works in reverse in hot parts of the world if one submerges the head, hands, or feet in cold water, it lets the most vascular parts of the body lose heat quickly.

14-8. Clothing Wear in Snow and Ice Areas:

a. The survivor should:

(1) Avoid restricting the circulation. Clothing should not be worn so tight that it restricts the flow of blood which distributes the body heat and helps prevent frostbite. When wearing more than one pair of socks or gloves, ensure that each succeeding pair is large enough to fit comfortably over the other. Don't wear three or four pairs of socks in a shoe fitted for only one or two pairs. Release any restriction caused by twisted clothing or a tight parachute harness.

(2) Keep the head and ears covered. Survivors will lose as much as 50 percent of their total body heat from an unprotected head at 50°F.

(3) When exerting the body, prevent perspiration by opening clothing at the neck and wrists and loosening it at the waist. If the body is still warm, comfort can be obtained by taking off outer layers of clothing, one layer at a time. When work stops, the individual should put the clothing on again to prevent chilling.

(4) If boots are big enough, use dry grass, moss, or other material for added insulation around the feet. Footgear can be improvised by wrapping parachute cloth or other fabric lined with dry grass or moss for insulation.

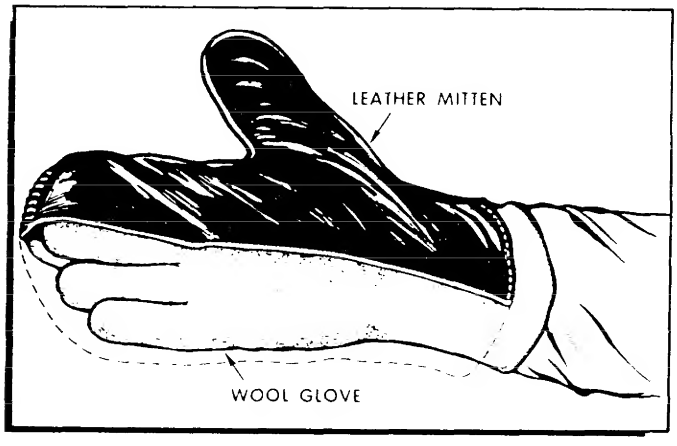


Figure 14-2. Layer System for Hands.

b. Felt booties and mukluks with the proper socks and insoles are best for dry, cold weather. Rubber-bottomed boot shoepacs with leather tops are best for wet weather. Mukluks should not be worn in wet weather. The vapor-barrier rubber boots can be worn under both conditions and are best at extremely low temperatures. The air release valve should be closed at ground level. These valves are designed to release pressure when airborne. Air should not be blown into the valves as the moisture could decrease insulation.

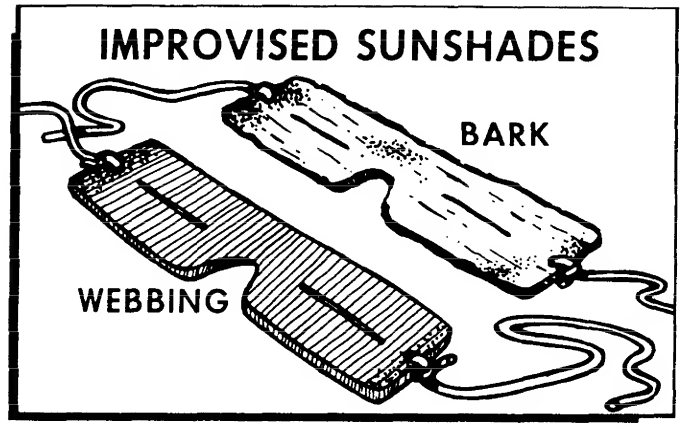


Figure 14-3. Improvised Goggles.

c. Clothing should be kept as dry as possible. Snow must be brushed from clothing before entering a shelter or going near a fire. The survivors should beat the frost out of garments before warming them, and dry them on a rack near a fire. Socks should be dried thoroughly.

d. One or two pairs of wool gloves and (or) mittens should be worn inside a waterproof shell (figure 14-2). If survivors have to expose their hands, they should warm them inside their clothing.

e. To help prevent sun or snow blindness, a survivor should wear sun or snow goggles or improvise a shield with a small horizontal slit opening (figure 14-3).

f. In strong wind or extreme cold, as a last resort, a survivor should wrap up in parachute material, if available, and get into some type of shelter or behind a windbreak. Extreme care should be taken with hard materials, such as synthetics, as they may become cold soaked and require more time to warm.

g. At night, survivors should arrange dry spare clothing loosely around and under the shoulders and hips to help keep the body warm. Wet clothes should never be worn into the sleeping bag. The moisture destroys the insulation value of the bag.

h. If survivors fall into water, they should roll in dry snow to blot up moisture, brush off the snow, and roll again until most of the water is absorbed. They should not remove footwear until they are in a shelter or beside a fire.

i. All clothing made of wool offers good protection when used as an inner layer. When wool is used next to the face and neck, survivors should be cautioned that moisture from the breath will condense on the surface and cause the insulating value to decrease. The use of a wool scarf wrapped around the mouth and nose is an excellent way to prevent cold injury, but it needs to be

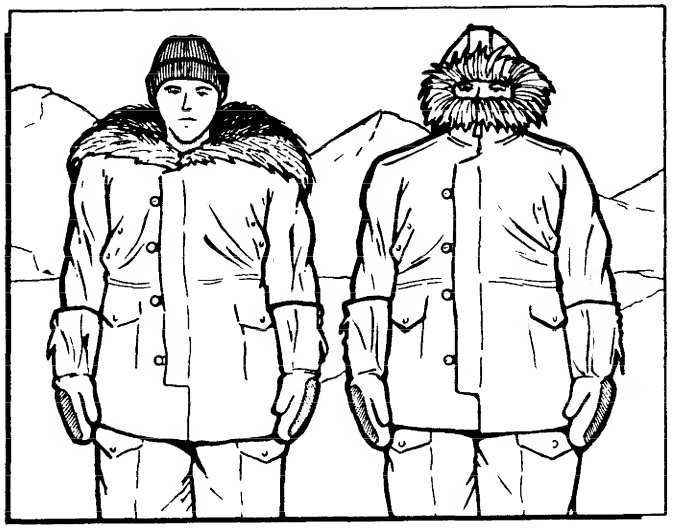


Figure 14-4. Proper Wear of Parka.

de-iced on a regular basis to prevent freezing flesh adjacent to it. An extra shell is generally worn over the warming layers to protect them and to act as a windbreak.

j. Other headgear includes the pile cap and hood. These items are most effective when used with a covering for the face in extreme cold. The pile cap is extremely warm where it is insulated, but it offers little protection for the face and back of the neck.

k. The hood is designed to funnel the radiant heat rising from the rest of the body and to recycle it to keep the neck, head, and face warm (figure 14-4). The individual's ability to tolerate cold should dictate the size of the front opening of the hood. The "tunnel" of a parka hood is usually lined with fur of some kind to act as a protecting device for the face. This same fur also helps to protect the hood from the moisture expelled during breathing. The closed tunnel holds heat close to the face longer; the open one allows the heat to escape more freely. As the frost settles on the hair of the fur, it should be shaken from time to time to keep it free of ice buildup.

l. Sleeping systems (sleeping bag, liner, and bed) are the transition "clothing" used between normal daytime activities and sleep (figure 14-7).

m. The insulating material in the sleeping bag may be synthetic or it may be down and feathers. (Feathers and down lining require extra protection from moisture). However, the covering is nylon. Survivors must realize that sleeping bags are compressed when packed and must be fluffed before use to restore insulation value. Clean and dry socks, mittens, and other clothing can be used to provide additional insulation.

n. Footgear is critical in a survival situation because walking is the only means of mobility. Therefore, care of footgear is essential both before and during a survival situation. Recommendations for care are:

(1) Ensure footgear is properly "broken-in" before flying.

(2) "Treat" footgear to ensure water-repellency (follow manufacturer's recommendations).

(3) Keep leather boots as dry as possible.

o. Mukluks have been around for thousands of years and have proven their worth in extremely cold weather. The Air Force mukluks are made of cotton duck with rubber-cleated soles and heels. (See figure 14-6.) They have slide fasteners from instep to collar, laces at instep and collar, and are 18 inches high. They are used by flying and ground personnel operating under *dry*, cold conditions in temperatures below + 15°F. Survivors should change liners daily when possible.

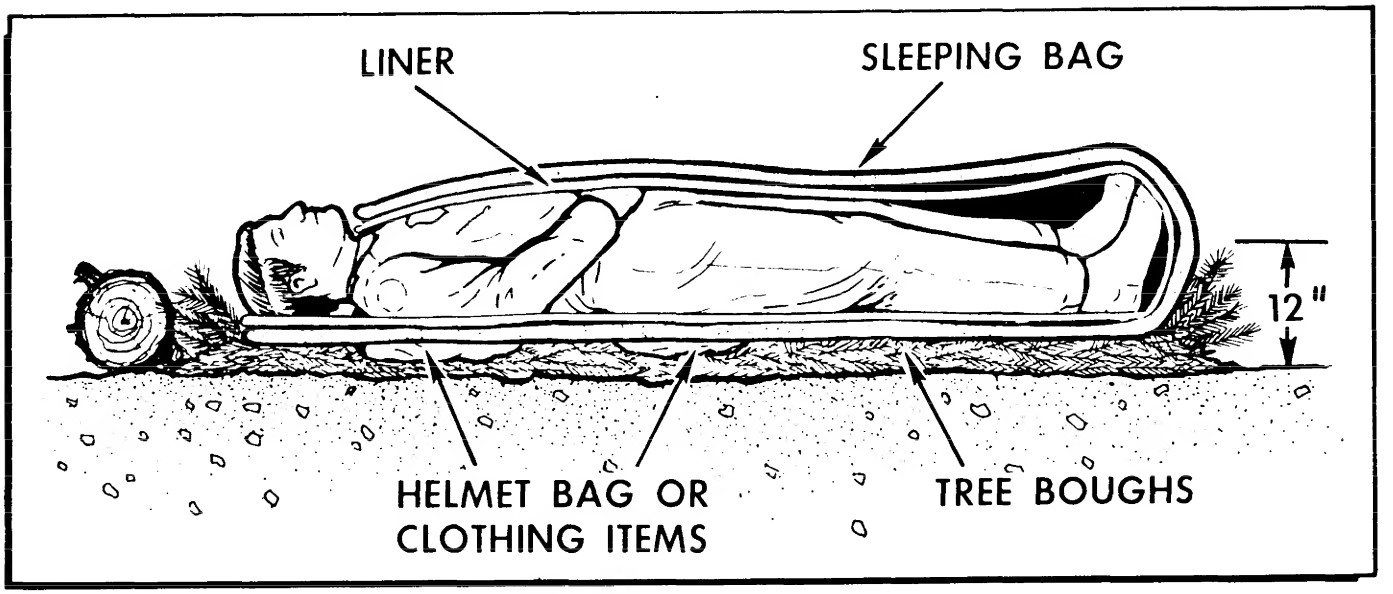


Figure 14-5. Sleeping System.

Figure 14-6. Issued Mukluks.

14-9. Care of the Feet. Foot care is critical in a survival situation. Improvising foot gear may be essential to caring for feet.

a. Moose Hock Shoe. The hock skin of a moose or caribou will provide a suitable pair of shoes (figure 14-7). Cut skin around leg at A and B. Separate from the leg and pull it over the hoof. Shape and sew up small end C. Slit skin from A to B; bore holes on each side of cut for lacing; turn inside out, and lace with rawhide, suspension line, or other suitable material.

b. Grass Insoles. Used extensively by northern natives to construct inner soles. Grass is a good insulator and will collect moisture from the feet. The survivor should use the following procedure to prepare grass for use as inner soles: Grasp a sheaf of tall grass, about one-half inch in diameter, with both hands. Rotate the hands in opposite directions. The grass will break up or "fluff" into a soft mass. Form this fluff into oblong shapes and spread it evenly throughout the shoes. The inner soles should be about an inch thick. Remove these inner soles at night and make new ones the following day.

c. Hudson Bay Duffel. A triangular piece of material used as a foot covering. To improvise this foot covering, a survivor can use the following procedures:

(1) Cut two to four layers of parachute cloth into a 30-inch square.

(2) Fold this square to form a triangle.

(3) Place the foot on this triangle with the toes pointing at one corner.

(4) Fold the front cover up over the toes.

(5) Fold the side corners, one at a time, over the instep. This completes the foot wrap. (See figure 14-8.)

d. Gaiters. Made from parachute cloth, webbing, or canvas. Gaiters help keep sand and snow out of shoes and protect the legs from bites and scratches (figure 14-9).

e. Double Socks. Cushion padding, feathers, dry grass, or fur stuffed between layers of socks. Wrap parachute or aircraft fabric around the feet and tie above the ankles. A combination of two or more types of improvised footwear may be more desirable and more efficient than any single type (figure 14-10).

14-10. Clothing in the Summer Arctic:

a. In the summer arctic, there are clouds of mosquitoes and black flies so thick a person can scarcely see through them. Survivors can protect themselves by wearing proper clothing to ensure no bare skin is exposed. A good head net and gloves should be worn.

b. Head nets must stand out from the face so they won't touch the skin. Issued head nets are either black or green. If one needs to be improvised they can be sewn to the brim of the hat or can be attached with an elastic band that fits around the crown. Black is the best color, as it can be seen through more easily than green or white. A heavy tape encasing a drawstring should be attached to the bottom of the head net for tying snugly at the collar. Hoops of wire fastened on the inside will make the net stand out from the face and at the same time allow it to be packed flat. The larger they are, the better the ventilation. But very large nets will not be as effective in wooded country where they may become snagged on brush.

c. Gloves are hot, but are a necessity where flies are found in swamps. Kid gloves with a 6-inch gauntlet closing the gap at the wrist and ending with an elastic band halfway to the elbow are best. For fine work, kid gloves with the fingers cut off are good. Cotton/Nomex work gloves are better than no protection at all, but mosquitoes will bite through them. Treating the gloves with insect repellent will help. Smoky clothing may also help to keep insects away. (See figure 14-11.)

d. A survivor should remember that mosquitoes do not often bite through two layers of cloth; therefore, a lightweight undershirt and long underwear will help. To

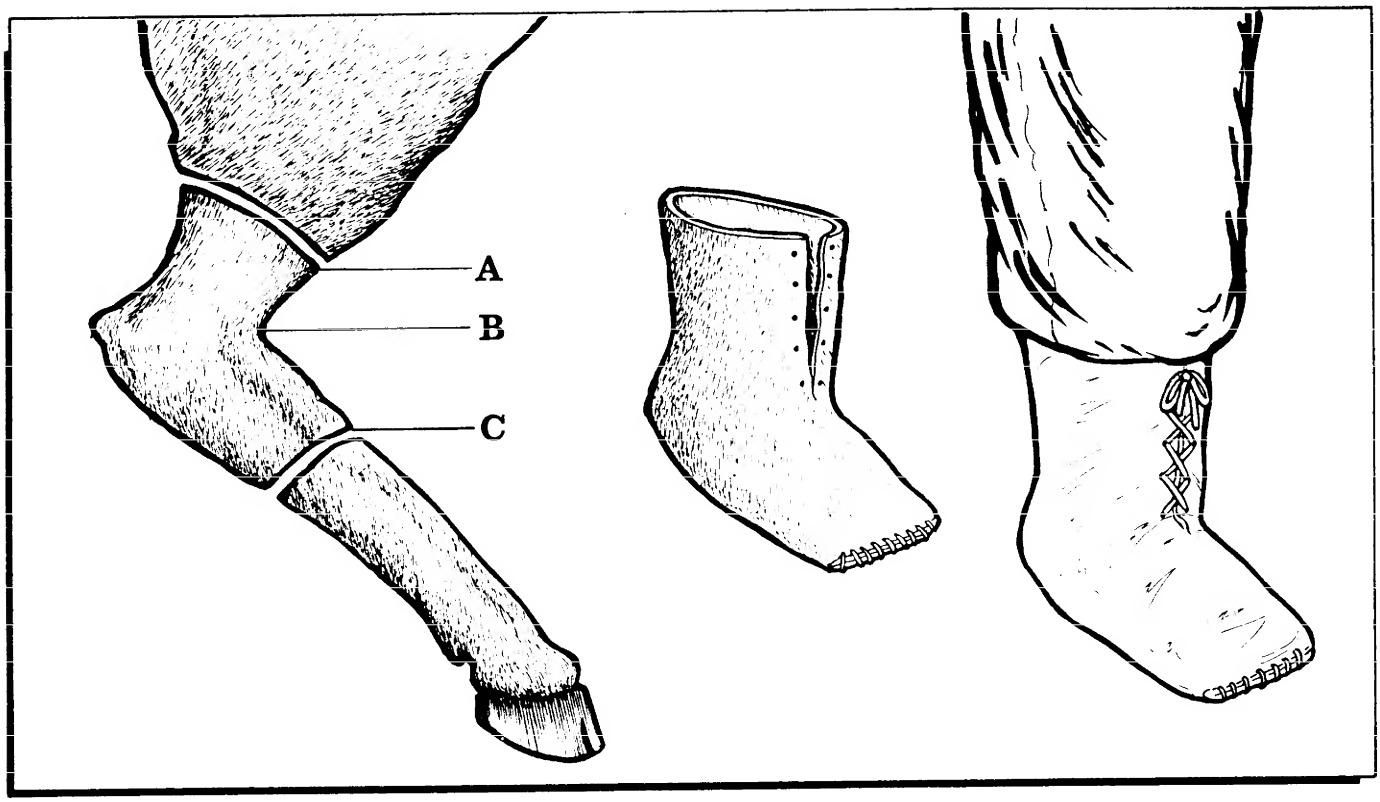


Figure 14-7. Moose Hock Shoes.

protect ankles, blouse the bottoms of trousers around boots, or wear some type of leggings (gaiters).

e. If the head net is lost or none is available, make the best of a bad situation by wearing sunglasses with improvised screened sides, plugging ears lightly with cotton, and tying a handkerchief around the neck. Treat clothing with insect repellent at night.

14-11. Clothing at Sea. In cold oceans, survivors must try to stay dry and keep warm. If wet, they should use a wind screen to decrease the cooling effects of the wind. They should also remove, wring out, and replace outer

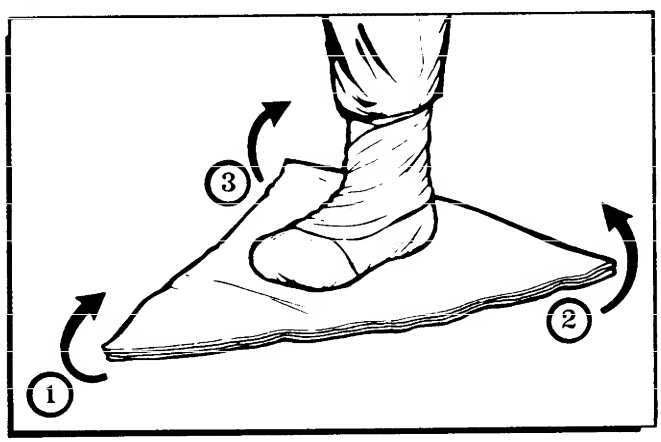


Figure 14-8. Hudson Bay Duffel.

Figure 14-9. Gaiters.

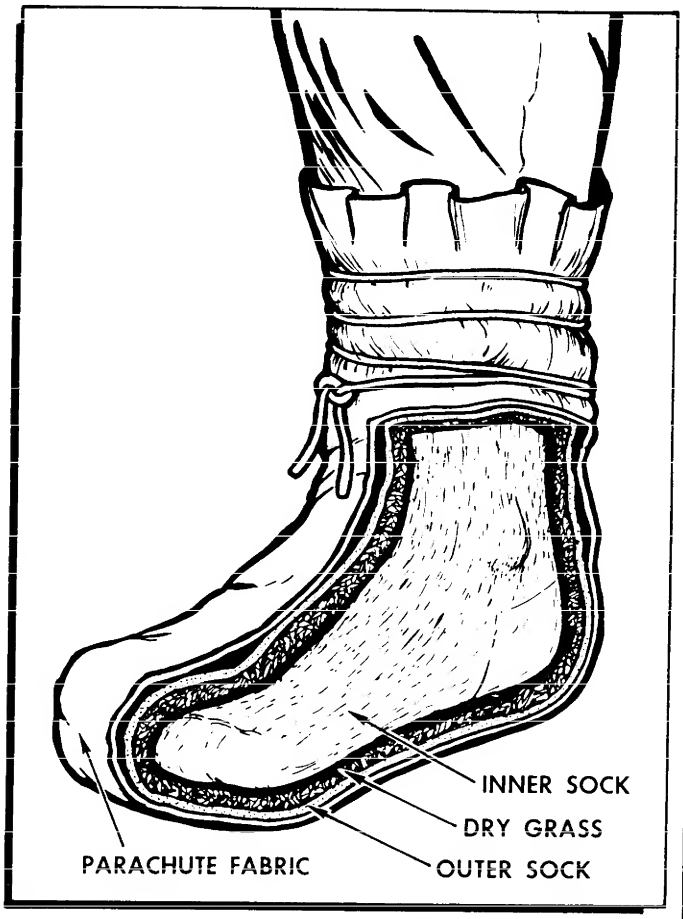


Figure 14-10. Double Socks.

garments or change into dry clothing. Hats, socks, and gloves should also be dried. If any survivors are dry, they should share extra clothes with those who are wet. Wet personnel should be given the most sheltered positions in the raft. Let them warm their hands and feet against those who are dry. Survivors should put on any extra clothing available. If no anti-exposure suits are provided, they can drape extra clothing around their shoulders and over their heads. Clothes should be loose and comfortable. Also, survivors should attempt to keep the floor of the raft dry. For insulation, covering the floor with any available material will help. Survivors should huddle together on the floor of the raft and spread extra tarpaulin, sail, or parachute material over the group. If in a 20- or 25-man raft, canopy sides can be lowered. Performing mild exercises to restore circulation may be helpful. Survivors should exercise fingers, toes, shoulders, and buttock muscles. Mild exercise will help keep the body warm, stave off muscle spasms, and possibly prevent medical problems. Survivors should warm hands under armpits and periodically raise feet slightly and hold them up for a minute or two. They should also move face muscles frequently to prevent frostbite. Shivering is the body's way of quickly generating heat and is considered normal. However, persistent shivering may lead to uncontrollable muscle spasms. They can be avoided by exercising muscles. If water is available, additional rations should be given to those suffering from exposure to cold. Survivors should eat small amounts frequently rather than one large meal.

Figure 14-11. Insect Protection.

14-12. Antiexposure Garments:

a. Assemblies. The antiexposure assemblies, both quick donning and constant wear, are designed for personnel participating in over-water flights where unprotected or prolonged exposure to the climatic conditions

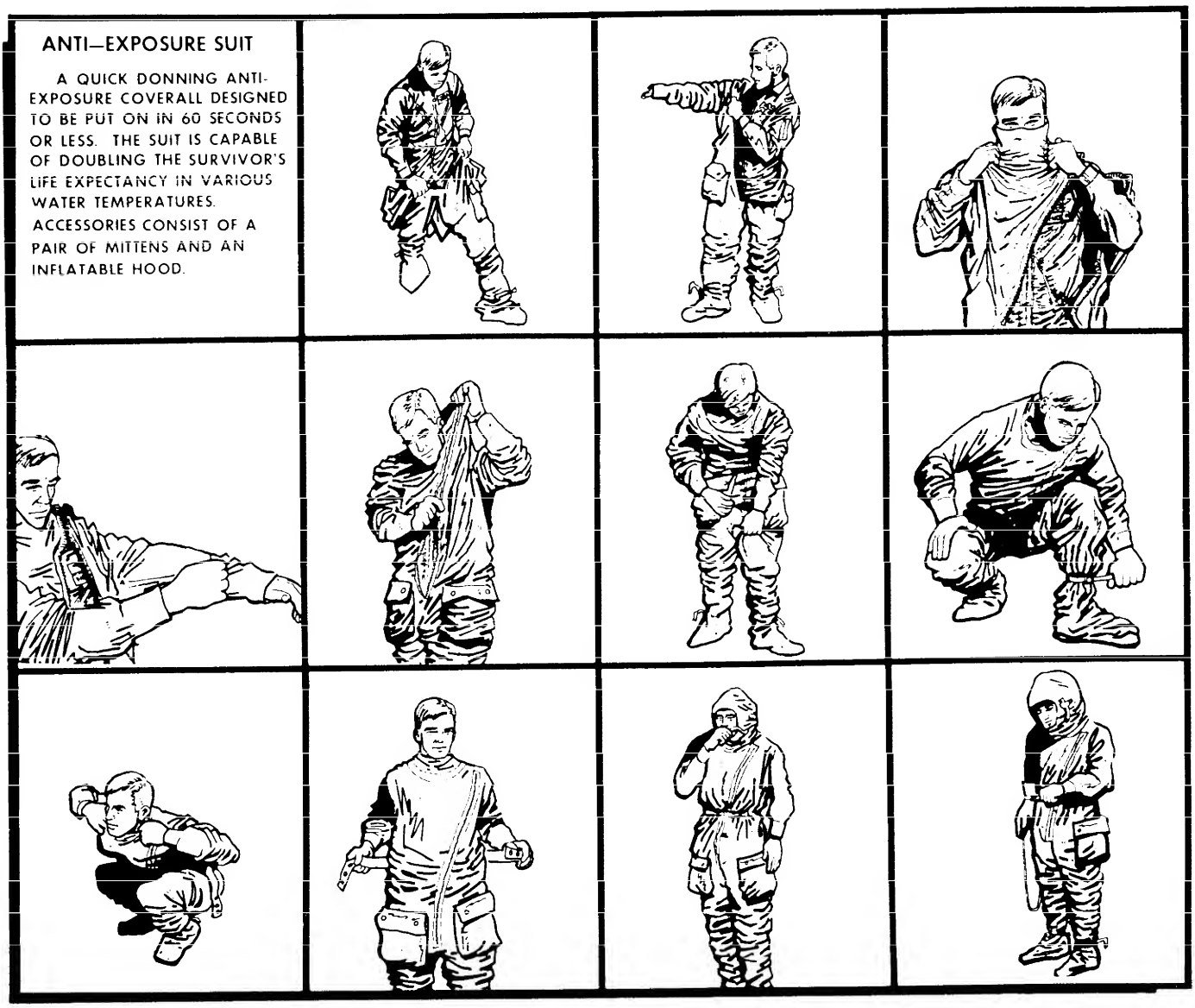


Figure 14-12. Donning Antiexposure Suit.

of cold air and (or) cold water (as a result of ditching or abandoning an aircraft) would be dangerous or could prove fatal. The suit provides protection from the wind and insulation against the chill of the ocean. The result of exposure in the water is illustrated in figures 13-2 and 13-3. Exposure time varies depending on the particular antiexposure assembly worn, the cold sensitiveness of the person, and survival procedures used.

b. Quick-Donning Antiexposure Flying Coverall. Some antiexposure coveralls are designed for quick donning (approximately 1 minute) before emergency ditching. After ditching the aircraft, the coverall protects the wearer from exposure while swimming in cold water, and from exposure to wind, spray, and rain when adrift in a liferaft.

(1) The coverall is a one-size garment made from chloroprene-coated nylon cloth. It has two expandable-type patch pockets, an adjustable waist belt, and attached boots with adjustable ankle straps. One pair of insulated, adjustable wrist strap mittens, each with a strap attached to a pocket, is provided. A hood, also attached with a strap, is in the left pocket. A carrying case with instructions and a snap fastener closure is furnished for stowing in the aircraft.

(2) To use the coverall, personnel should wear it over regular flight clothing. It is large enough to wear over the usual flight gear. The gloves and hood are stowed in the pockets of the coverall and are normally worn after boarding the liferaft.

(3) The survivor should be extremely careful when donning the coverall to prevent damage by snagging.

tearing, or puncturing it on projecting objects. After donning the coverall, the waist band and boot ankle straps should be adjusted to take up fullness. If possible, crewmembers should stoop while pulling the neck seal to expel air trapped in the suit. When jumping into the water, they should leap feet first with hands and arms close to sides or brought together above the head (figure 14-12). Note there is a constant wear exposure suit designed to be worn continuously during overwater flights where the water temperature is 60 degrees or below. The Command may waiver it to 51 degrees.

14-13. Warm Oceans. Protection against the Sun and securing drinking water are the most important problems. A survivor should keep the body covered as much as possible to avoid sunburn. A sunshade can be improvised out of any materials available or the canopy provided with the raft may be used. If the heat becomes too intense, survivors may dampen clothing with sea water to promote evaporation and cooling. The use of sunburn preventive cream or a Chapstick is advisable. Remember, the body must be kept covered completely. Exposure to the Sun increases thirst, wastes precious water, reduces the body's water content, and causes serious burns. Survivors should roll down their sleeves, pull up their socks, close their collars, wear a hat or improvised headgear, use a piece of cloth as a shield for the back of the neck, and wear sunglasses or improvise eye covers.

14-14. Tropical Climates:

a. In tropical areas, the body should be kept covered for prevention of insect bites, scratches, and sunburn.

b. When moving through vegetation, survivors should roll down their sleeves, wear gloves, and blouse the legs of their pants or tie them over their boot tops. Improvised puttees (gaiters) can be made from parachute material or any available fabric. This will protect legs from ticks and leeches.

c. Loosely worn clothing will keep survivors cooler, especially when subjected to the direct rays of the Sun.

d. Survivors should wear a head net or tie material around the head for protection against insects. The most active time for insects is at dawn and dusk. An insect repellent should be used at these times.

e. In open country or in high grass, survivors should wear a neck cloth or improvised head covering for protection from sunburn and (or) dust. They should also move carefully through tall grass, as some sharp-edged grasses can cut clothing to shreds. Survivors should dry clothing before nightfall. If an extra change of clothing is available, effort should be made to keep it clean and dry.

14-15. Dry Climates:

a. In the dry climates of the world, clothing will be needed for protection against sunburn, heat, sand, and insects. Survivors should not discard any clothing. They should keep their head and body covered and blouse the legs of pants over the tops of footwear during the day. Survivors should not roll up sleeves, but keep them rolled down and loose at the cuff to stay cool.

Figure 14-13. Protective Desert Clothing.

b. Survivors should keep in mind that the people who live in the hot dry areas of the world usually wear heavy white flowing robes which protect almost every inch of their bodies. The only areas open to the Sun are the face and the eyes. This produces an area of higher humidity between the body and the clothing, which helps keep them cooler and conserves their perspiration (figure 14-13). The white clothing also reflects the sunlight.

c. Survivors should wear a cloth neckpiece to cover the back of the neck and protect it from the Sun. A T-

shirt makes an excellent neck drape, with the extra material used as padding under the cap. If hats are not available, survivors can make headpieces like those worn by the Arabs, as shown in figure 14-13. During dust storms, they should wear a covering for the mouth and nose; parachute cloth will work.

d. If shoes are lost or if they wear out, survivors can improvise footgear. One example of this is the "Russian Sock." Parachute material can be used to improvise these socks. The parachute material is cut into strips approximately 2 feet long and 4 inches wide. These strips are wrapped bandage fashion around the feet and ankles. Socks made in this fashion will provide comfort and protection for the feet.

Chapter 15

SHELTER

15-1. Introduction. Shelter is anything that protects a survivor from the environmental hazards. The information in this chapter describes how the environment influences shelter site selection and factors which survivors must consider before constructing an adequate shelter. The techniques and procedures for constructing shelters for various types of protection are also presented.

15-2. Shelter Considerations. The location and type of shelter built by survivors vary with each survival situation. There are many things to consider when picking a site. Survivors should consider the time and energy required to establish an adequate camp, weather conditions, life forms (human, plant, and animal), terrain, and time of day. Every effort should be made to use as little energy as possible and yet attain maximum protection from the environment.

a. Time. Late afternoon is not the best time to look for a site which will meet that day's shelter requirements. If survivors wait until the last minute, they may be forced to use poor materials in unfavorable conditions. They must constantly be thinking of ways to satisfy their needs for protection from environmental hazards.

b. Weather. Weather conditions are a key consideration when selecting a shelter site. Failure to consider the weather could have disastrous results. Some major weather factors which can influence the survivor's choice of shelter type and site selection are temperature, wind, and precipitation.

(1) Temperature. Temperatures can vary considerably within a given area. Situating a campsite in low areas such as a valley in cold regions can expose survivors to low night temperatures and windchill factors. Colder temperatures are found along valley floors which are sometimes referred to as "cold air sumps." It may be advantageous to situate campsites to take advantage of the Sun. Survivors could place their shelters in open areas during the colder months for added warmth, and in shaded areas for protection from the Sun during periods of hotter weather. In some areas a compromise may have to be made. For example, in many deserts the daytime temperatures can be very high while low temperatures at night can turn water to ice. Protection from both heat and cold are needed in these areas. Shelter type and location should be chosen to provide protection from the existing temperature conditions.

(2) Wind. Wind can be either an advantage or a disadvantage depending upon the temperature of the area and the velocity of the wind. During the summer or on warm days, survivors can take advantage of the cool breezes and protection the wind provides from insects by locating their camps on knolls or spits of land. Conversely, wind can become an annoyance or even a hazard as blowing sand, dust, or snow can cause skin and eye irritation and damage to clothing and equipment. On cold days or during winter months, survivors should seek shelter sites which are protected from the effects of windchill and drifting snow.

(3) Precipitation. The many forms of precipitation (rain, sleet, hail, or snow) can also present problems for survivors. Shelter sites should be out of major drainages and other low areas to provide protection from flash floods or mud slides resulting from heavy rains. Snow can also be a great danger if shelters are placed in potential avalanche areas.

c. Life Forms. All life forms (plant, human, and animal) must be considered when selecting the campsite and the type of shelter that will be used. The "human" factor may mean the enemy or other groups from whom survivors wish to remain undetected. Information regarding this aspect of shelters and shelter site selection is in part nine of this regulation (Evasion). For a shelter to be adequate, certain factors must be considered, especially if extended survival is expected.

(1) Insect life can cause personal discomfort, disease, and injury. By locating shelters on knolls, ridges, or any other area that has a breeze or steady wind, survivors can reduce the number of flying insects in their area. Staying away from standing water sources will help to avoid mosquitoes, bees, wasps, and hornets. Ants can be a major problem; some species will vigorously defend their territories with painful stings or bites or particularly distressing pungent odors.

(2) Large and small animals can also be a problem, especially if the camp is situated near their trails or waterholes.

(3) Dead trees that are standing, and trees with dead branches should be avoided. Wind may cause them to fall, causing injuries or death. Poisonous plants, such as poison oak or poison ivy, must also be avoided when locating a shelter.

d. Terrain. Terrain hazards may not be as apparent as weather and animal life hazards, but they can be many times more dangerous. Avalanche, rock, dry streambeds, or mud-slide areas should be avoided. These areas can be recognized by either a clear path or a path of secondary vegetation, such as 1- to 15-foot tall vegetation or other new growth which extends from the top to the bottom of a hill or mountain. Survivors should not choose shelter sites at the bottom of steep slopes which may be prone to slides. Likewise, there is a danger in camping at the bottom of steep scree or talus slopes. Additionally, rock overhang must be checked for safety before using it as a shelter.

15-3. Location:

a. Four prerequisites must be satisfied when selecting a shelter location.

(1) The first is being near water, food, fuel, and a signal or recovery site.

(2) The second is that the area be safe, providing natural protection from environmental hazards.

(3) The third is that sufficient materials be available to construct the shelter. In some cases, the "shelter" may already be present. Survivors seriously limit themselves if they assume shelters *must* be a fabricated framework having predetermined dimensions and a cover of parachute material or a signal paulin. More appropriately, survivors should consider using sheltered *places* already in existence in the immediate area. This does not rule out shelters with a fabricated framework and parachute or other manufactured material covering; it simply enlarges the scope of what can be used as a survival shelter.

(4) Finally, the area chosen must be both large enough and level enough for the survivor to lie down. Personal comfort is an important fundamental for survivors to consider. An adequate shelter provides physical and mental well-being for sound rest. Adequate rest is extremely vital if survivors are to make sound decisions. Their need for rest becomes more critical as time passes and rescue or return is delayed. Before actually constructing a shelter, survivors must determine the specific purpose of the shelter. The following factors influence the type of shelter to be fabricated.

(a) Rain or other precipitation.

(b) Cold.

(c) Heat.

(d) Insects.

(e) Available materials nearby (manufactured or natural).

(f) Length of expected stay.

(g) Enemy presence in the area—evasion "shelters" are covered in part nine of the regulation (Evasion).

(h) Number and physical condition of survivors.

b. If possible, survivors should try to find a shelter which needs little work to be adequate. Using what is already there, so that complete construction of a shelter is not necessary, saves time and energy. For example, rock overhangs, caves, large crevices, fallen logs, root buttresses, or snow banks can all be modified to provide adequate shelter. Modifications may include adding snow blocks to finish off an existing tree well shelter, increasing the insulation of the shelter by using vegetation or parachute material, etc., or building a reflector fire in front of a rock overhang or cave. Survivors must consider the amount of energy required to build the shelter. It is not really wise to spend a great deal of time and energy in constructing a shelter if nature has provided a natural shelter nearby which will satisfy the survivor's needs. See figure 15-1 for examples of naturally occurring shelters.

c. The size limitations of a shelter are important only if there is either a lack of material on hand or if it is

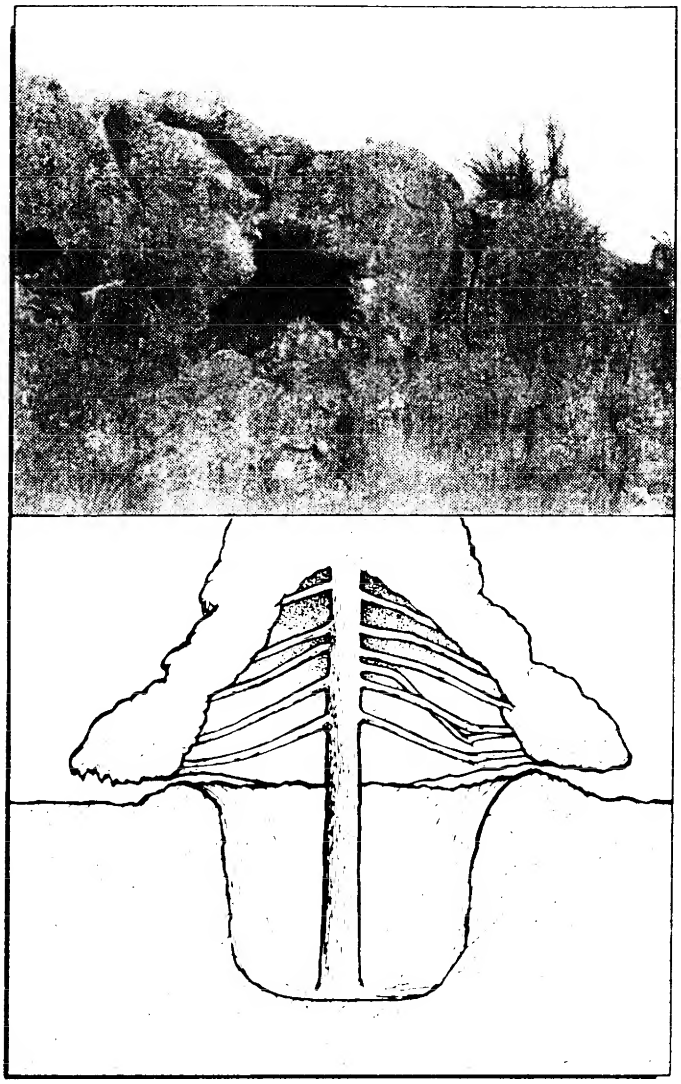


Figure 15-1. Natural Shelter.

cold. Otherwise, the shelter should be large enough to be comfortable yet not so large as to cause an excessive amount of work. Any shelter, naturally occurring or otherwise, in which a fire is to be built must have a ventilation system which will provide fresh air and allow smoke and carbon monoxide to escape. Even if a fire does not produce visible smoke (such as heat tabs), the shelter must still be vented. See figure 15-27 for placement of ventilation holes in a snow cave. If a fire is to be placed outside the shelter, the opening of the shelter should be placed 90 degrees to the prevailing wind. This will reduce the chances of sparks and smoke being blown into the shelter if the wind should reverse direction in the morning and evening. This frequently occurs

in mountainous areas. The best fire to shelter distance is approximately 3 feet. One place where it would not be wise to build a fire is near the aircraft wreckage, especially if it is being used as a shelter. The possibility of igniting spilled lubricants or fuels is great. Survivors may decide instead to use materials from the aircraft to add to a shelter located a safe distance from the crash site.

15-4. Immediate Action Shelters. The first type of shelter that survivors may consider using, or the first type they may be forced to use, is an immediate action shelter. An immediate action shelter is one which can be erected quickly with minimum effort; for example, raft, aircraft parts, parachutes, paulin, and plastic bag. Natural formations can also shield survivors from the elements immediately, to include overhanging ledges, fallen logs, caves, and tree wells (figure 15-2). It isn't necessary to be concerned with exact shelter dimensions. Survivors should remember that if shelter is needed, use an existing shelter if at all possible. They should improvise on natural shelters or construct new shelters only if necessary. Regardless of type, the shelter must provide whatever protection is needed and, with a little ingenuity, it should be possible for survivors to protect themselves and do so quickly. In many instances, the immediate action shelters may have to serve as permanent shelters for aircrew members. For example, many aircrew members fly without parachutes, large cutting implements (axes), and entrenching tools; therefore, multiperson liferafts may be the only immediate or long-term shelter available. In this situation, multiperson liferafts must be deployed in the quickest manner possible to ensure maximum advantages are attained from the following shelter principles:

a. Set up in areas which afford maximum protection from precipitation and wind and use the basic shelter principle in paragraphs 15-2 and 15-3.

b. Anchor the raft for retention during high winds.

c. Use additional boughs, grasses, etc., for ground insulation.

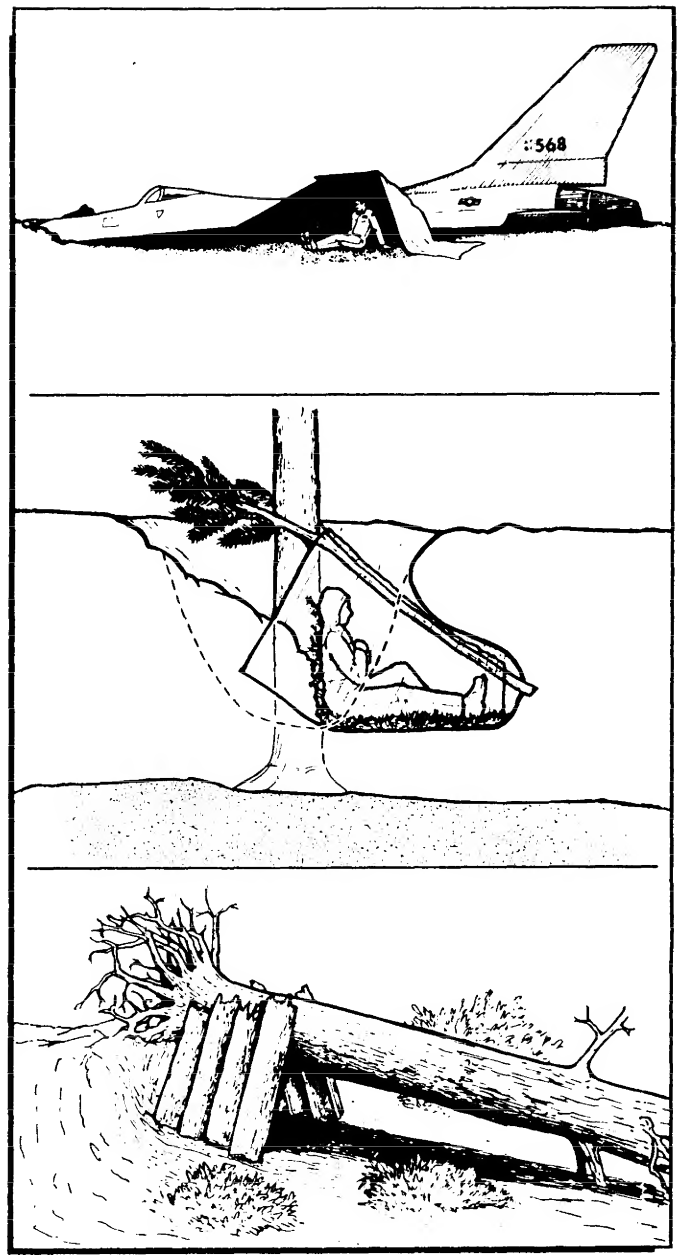


Figure 15-2. Immediate Action Shelters.

15-5. Improvised Shelters. Shelters of this type should be easy to construct and (or) dismantle in a short period of time. However, these shelters usually require more time to construct then an immediate action shelter. For this reason, survivors should only consider this type of shelter when they aren't immediately concerned with getting out of the elements. Shelters of this type include the following:

a. The "A frame" design is adaptable to all environments as it can be easily modified; for example, tropical para-hammock, temperate area "A frame," arctic thermal "A frame," and fighter trench.

b. Simple shade shelter; these are useful in dry areas.

c. Various paratepees.

d. Snow shelters; includes tree-pit shelters.

e. All other variations of the above shelter types; sod shelters, etc.

15-6. Shelters for Warm Temperature Areas:

a. If survivors are to use parachute material, they should remember that "pitch and tightness" apply to shelters designed to shed rain or snow. Parachute material is porous and will not shed moisture unless it is stretched tightly at an angle of sufficient pitch which will encourage run-off instead of penetration. An angle of 40 to 60 degrees is recommended for the "pitch" of the shelter. The material stretched over the framework

should be wrinkle-free and tight. Survivors should not touch the material when water is running over it as this will break the surface tension at that point and allow water to drip into the shelter. Two layers of parachute material, 4 to 6 inches apart, will create a more effective water repellent covering. Even during hard rain, the outer layer only lets a mist penetrate if it is pulled tight. The inner layer will then channel off any moisture which may penetrate. This layering of parachute material also creates a dead-air space that covers the shelter. This is especially beneficial in cold areas when the shelter is enclosed. Adequate insulation can also be provided by boughs, aircraft parts, snow, etc. These will be discussed in more depth in the area of cold climate shelters. A double layering of parachute material helps to trap body heat, radiating heat from the Earth's surface, and other heating sources.

b. The first step is deciding the type of shelter required. No matter which shelter is selected, the building or improvising process should be planned and orderly, following proven procedures and techniques. The second step is to select, collect, and prepare all materials needed before the actual construction; this includes framework, covering, bedding, or insulation, and implements used to secure the shelter ("dead-men," lines, stakes, etc.).

(1) For shelters that use a wooden framework, the poles or wood selected should have all the rough edges and stubs removed. Not only will this reduce the chances of the parachute fabric being ripped, but it will eliminate the chances of injury to survivors.

(2) On the outer side of a tree selected as natural shelter, some or all of the branches may be left in place as they will make a good support structure for the rest of the shelter parts.

(3) In addition to the parachute, there are many other materials which can be used as framework cover-

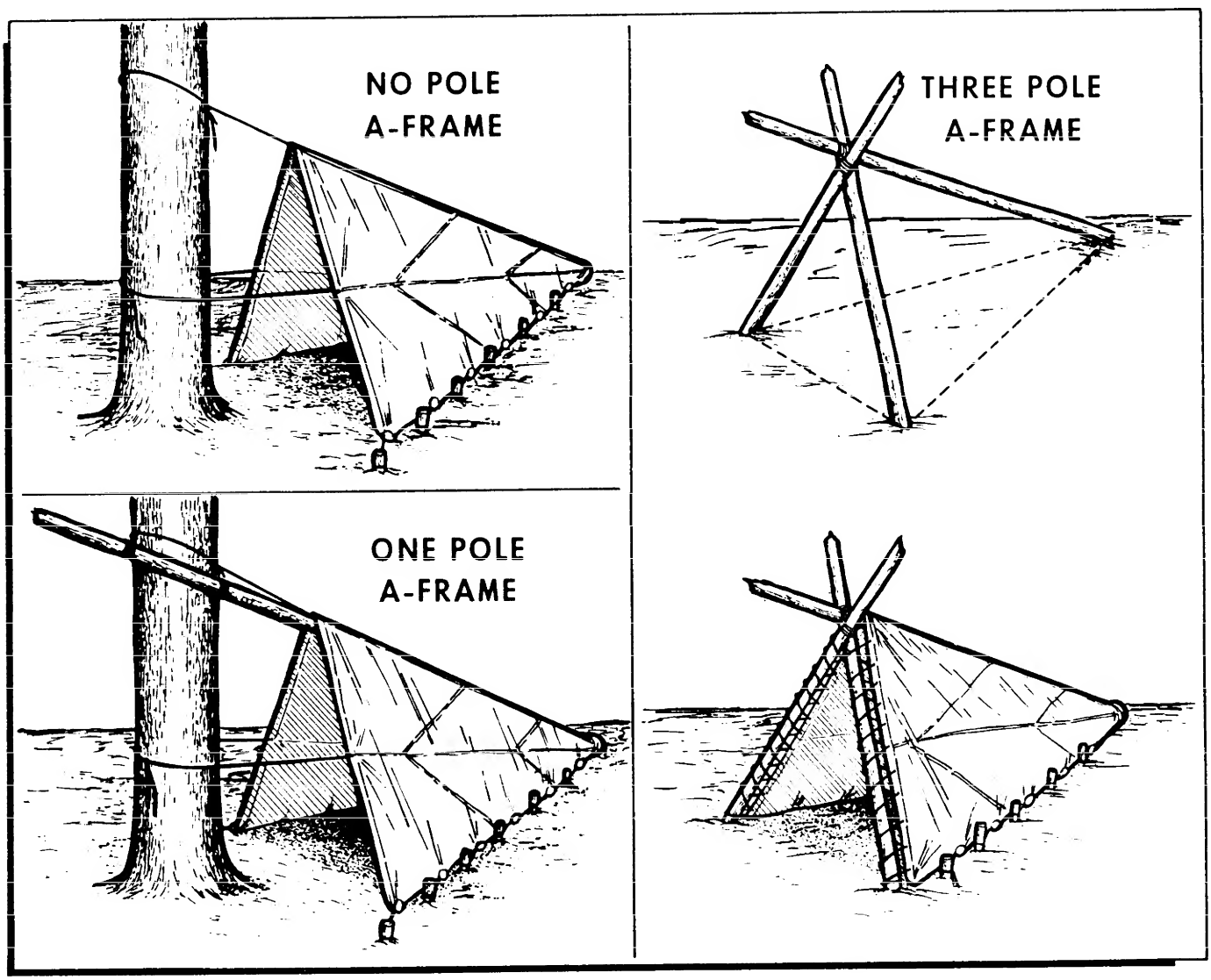


Figure 15-3. A-Frame Shelters.

ings. Some of the following are both framework and covering all in one:

(a) Bark peeled off dead trees.

(b) Boughs cut off trees.

(c) Bamboo, palm, grasses, and other vegetation cut or woven into desired patterns.

(4) If parachute material is to be used alone or in combination with natural materials, it must be changed slightly. Survivors should remove all of the lines from the parachute and then cut it to size. This will eliminate bunching and wrinkling and reduce leakage.

c. The third step in the process of shelter construction is site preparation. This includes brushing away rocks and twigs from the sleeping area and cutting back overhanging vegetation.

d. The fourth step is to actually construct the shelter, beginning with the framework. The framework is very important. It must be strong enough to support the weight of the covering and precipitation buildup of snow. It must also be sturdy enough to resist strong wind gusts.

(1) Construct the framework in one of two ways. For natural shelters, branches may be securely placed against trees or other natural objects. For parachute shelters, poles may be lashed to trees or to other poles. The support poles or branches can then be layed and (or) attached depending on their function.

(2) The pitch of the shelter is determined by the framework. A 60-degree pitch is optimum for shedding precipitation and providing shelter room.

(3) The size of the shelter is controlled by the framework. The shelter should be large enough for survivors to sit up, with adequate room to lie down and to store all personal equipment.

(4) After the basic framework has been completed, survivors can apply and secure the framework covering. The care and techniques used to apply the covering will determine the effectiveness of the shelter in shedding precipitation.

(5) When using parachute material on shelters, survivors should remove all suspension line from the material. (Excess line can be used for lashing, sewing, etc.) Next, stretch the center seam tight; then work from the back of the shelter to the front, alternating sides and securing the material to stakes or framework by using buttons and lines. When stretching the material tight, survivors should pull the material 90 degrees to the wrinkles. If material is not stretched tight, any moisture will pool in the wrinkles and leak into the shelter.

(6) If natural materials are to be used for the covering, the shingle method should be used. Starting at the bottom and working toward the top of the shelter, the bottom of each piece should overlap the top of the preceding piece. This will allow water to drain off. The material should be placed on the shelter in sufficient quantity so that survivors in the shelter cannot see through it.

15-7. Maintenance and Improvements. Once a shelter is constructed, it must be maintained. Additional modifications may make the shelter more effective and comfortable. Indian lacing (lacing the front of the shelter to the bipod) will tighten the shelter. A door may help block the wind and keep insects out. Other modifications may include a fire reflector, porch or work area, or another whole addition such as an opposing lean-to.

15-8. Construction of Specific Shelters:

a. A-Frame. The following is one way to build an A-frame shelter in a warm temperate environment using parachute material for the covering. There are as many variations of this shelter as there are builders. The procedures here will, if followed carefully, result in the completion of a safe shelter that will meet survivors' needs. For an example of this and other A-frame shelters, see figure 15-3.

(1) Materials Needed:

(a) One 12 to 18 foot long sturdy ridge pole with all projections cleaned off.

(b) Two bipod poles, approximately 7 feet long.

(c) Parachute material, normally 5 or 6 gores.

(d) Suspension lines.

(e) "Buttons," small objects placed behind gathers of material to provide a secure way of affixing suspension line to the parachute material.

(f) Approximately 14 stakes, approximately 10 inches long.

(2) Assembling the Framework:

(a) Lash (See chapter 17 — Equipment.) the two bipod poles together at eye-level height.

(b) Place the ridge pole, with the large end on the ground, into the bipod formed by the poles and secure with a square lash.

(c) The bipod structure should be 90 degrees to the ridge pole and the bipod poles should be spread out to an approximate equilateral triangle of a 60-degree pitch. A piece of line can be used to measure this.

(3) Application of Fabric:

(a) Tie off about 2 feet of the apex in a knot and tuck this under the butt end of the ridge pole. Use half hitches and clove hitches to secure the material to the base of the pole.

(b) Place the center radial seam of the parachute piece (or the center of the fabric) on the ridge pole. After pulling the material taut, use half hitches and clove hitches to secure the fabric to the front of the ridge pole.

(c) Scribe or draw a line on the ground from the butt of the ridge pole to each of bipod poles. Stake the fabric down, starting at the rear of the shelter and alternately staking from side to side to the shelter front. Use a sufficient number of stakes to ensure the parachute material is wrinkle-free.

(d) Stakes should be slanted or inclined away from the direction of pull. When tying off with a clove

hitch, the line should pass in front of the stake first and then pass under itself to allow the button and line to be pulled 90 degrees to the wrinkle.

(e) Indian lacing is the sewing or lacing of the lower lateral band with inner core or line which is secured to the bipod poles. This will remove the remaining wrinkles and further tighten the material.

(f) A rain fly, bed, and other refinements can now be added.

b. Lean-To:

(1) Materials Needed:

(a) A sturdy, smooth ridge pole (longer than the builder's body) long enough to span the distance between two sturdy trees.

(b) Support poles, 10 feet long.

(c) Stakes, suspension lines, and buttons.

(d) Parachute material (minimum of four gores).

(2) Assembling the Framework:

(a) Lash the ridge pole (between two suitable trees) about chest or shoulder high.

(b) Lay the roof support poles on the ridge pole so the roof support poles and the ground are at approximately a 60-degree angle. Lash the roof support poles to the ridge pole.

(3) Application of Fabric:

(a) Place the middle seam of the fabric on the middle support pole with lower lateral band along the ridge pole.

(b) Tie-off the middle and both sides of the lower lateral band approximately 8 to 10 inches from the ridge pole.

(c) Stake the middle of the rear of the shelter first, then alternate from side to side.

(d) The stakes that go up the sides to the front should point to the front of the shelter.

(e) Pull the lower lateral band closer to the ridge pole by indian lacing.

(f) Add bed and other refinements (reflector fire, bed logs, rain fly, etc.). See figure 15-4 for lean-to examples.

c. Paratepee, 9-Pole. The paratepee is an excellent shelter for protection from wind, rain, cold, and insects. Cooking, eating, sleeping, resting, signaling, and washing can all be done without going outdoors. The paratepee, whether 9-pole, 1-pole, or no-pole, is the only improvised shelter that provides adequate ventilation to build an inside fire. With a small fire inside, the shelter also serves as a signal at night.

(1) Materials Needed:

(a) Suspension line.

(b) Parachute material, normally 14 gores are suitable.

-1. Spread out the 14-gore section of parachute and cut off all lines at the lower lateral band, leaving about 18 inches of line attached. All other suspension lines should be stripped from the parachute.

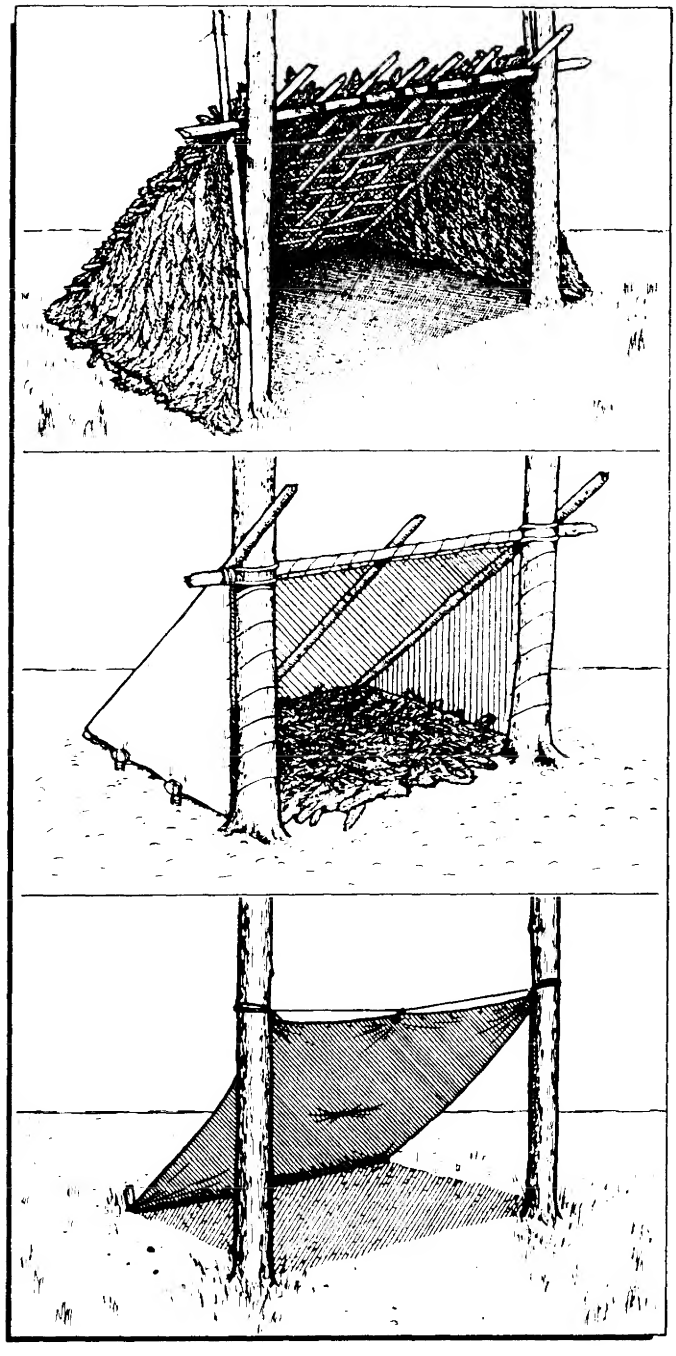


Figure 15-4. Lean-To Shelters.

-2. Sew two smoke flaps, made from two large panels of parachute material, at the apex of the 14-gore section on the outside seams. Attach suspension line with a bowline in the end to each smoke flap. The ends of the smoke flap poles will be inserted in these (see figure 15-5).

(c) Stakes.

(d) Although any number of poles may be used, 11 poles, smoothed off, each about 20 feet long, will normally provide adequate support.

(2) Assembling the Framework. (Assume 11 poles are used. Adjust instructions if different numbers are used.)

(a) Lay three poles on the ground with the butts even. Stretch the canopy along the poles. The lower lateral band should be 4 to 6 inches from the bottoms of the poles before the stretching takes place. Mark one of the poles at the apex point.

(b) Lash the three poles together, 5 to 10 inches above the marked area. (A shear lash is effective for this purpose.) These poles will form the tripod (figure 15-5).

(c) Scribe a circle approximately 12 feet in diameter in the shelter area and set the tripod so the butts of the poles are evenly spaced on the circle. Five of the remaining eight poles should be placed so the butts are evenly spaced around the 12-foot circle and the tops are laid in the apex of the tripod to form the smallest apex possible (figure 15-5).

(3) Application of Fabric:

(a) Stretch the parachute material along the tie pole. Using the suspension line attached to the middle radial seam, tie the lower lateral band to the tie pole 6 inches from the butt end. Stretch the parachute material along the middle radial seam and tie it to the tie pole using the suspension line at the apex. Lay the tie pole onto the shelter frame with the butt along the 12-foot circle and the top in the apex formed by the other poles. The tie pole should be placed directly opposite the proposed door.

(b) Move the canopy material (both sides of it) from the tie pole around the framework and tie the lower lateral band together and stake it at the door. The front can now be sewn or pegged closed, leaving 3 to 4 feet for a door. (A sewing "ladder" can be made by lashing steps up the front of the tepee (figure 15-5).

(c) Enter the shelter and move the butts of the poles outward to form a more perfect circle and until the fabric is relatively tight and smooth.

(d) Tighten the fabric and remove remaining wrinkles. Start staking directly opposite the door, and alternate from side to side, pulling the material down and to the front of the shelter. Use clove hitches or similar knots to secure material to the stakes.

(e) Insert the final two poles into the loops on the smoke flaps. The paratepee is now finished (figure 15-5).

(f) One improvement which could be made to the paratepee is the installation of a liner. This will allow a draft for a fire without making the occupants cold, since there may be a slight gap between the lower lateral band and the ground. A liner can be affixed to the inside of the paratepee by taking the remaining 14-gore piece of material and firmly staking the lower lateral band directly to the ground all the way around, leaving room for the door. The area where the liner and door meet may be sewn up. The rest of the material is brought up the inside walls and affixed to the poles with buttons (figure 15-5).

d. Paratepee, 1-Pole:

(1) Materials Needed:

(a) Normally use a 14-gore section of canopy, strip the shroud lines leaving 16- to 18-inch lengths at the lower lateral band.

(b) Stakes.

(c) Inner core and needle.

(2) Construction of the 1-Pole Paratepee:

(a) Select a shelter site and scribe a circle about 14 feet in diameter on the ground.

(b) The parachute material is staked to the ground using the lines attached at the lower lateral band. After deciding where the shelter door will be located, stake the first line (from the lower band) down securely. Proceed around the scribed line and stake down all the lines from the lateral band, making sure the parachute material is stretched taut before the line is staked down.

(c) Once all the lines are staked down, loosely attach the center pole, and, through trial and error, determine the point at which the parachute material will be pulled tight once the center pole is placed upright—securely attach the material at this point.

(d) Using a suspension line (or innercore), sew the end gores together leaving 3 or 4 feet for a door (figure 15-6).

e. Paratepee, No-Pole. For this shelter, the 14 gores of material are prepared the same way. A line is attached to the apex and thrown over a tree limb, etc., and tied off. The lower lateral band is then staked down starting opposite the door around a 12- to 14-foot circle. (See figure 15-7 for paratepee example.)

f. Sod Shelter. A framework covered with sod provides a shelter which is warm in cold weather and one that is easily made waterproof and insect-proof in the summer. The framework for a sod shelter must be strong, and it can be made of driftwood, poles, willow, etc. (Some natives use whale bones.) Sod, with a heavy growth of grass or weeds, should be used since the roots tend to hold the soil together. Cutting about 2 inches of soil along with the grass is sufficient. The size of the blocks are determined by the strength of the individual. A sod house is strong and fireproof.

15-9. Shelter for Tropical Areas. Basic considerations for shelter in tropical areas are as follows:

a. In tropical areas, especially moist tropical areas, the major environmental factors influencing both site selection and shelter types are:

(1) Moisture and dampness.

(2) Rain.

(3) Wet ground.

(4) Heat.

(5) Mud-slide areas.

(6) Dead standing trees and limbs.

(7) Insects.

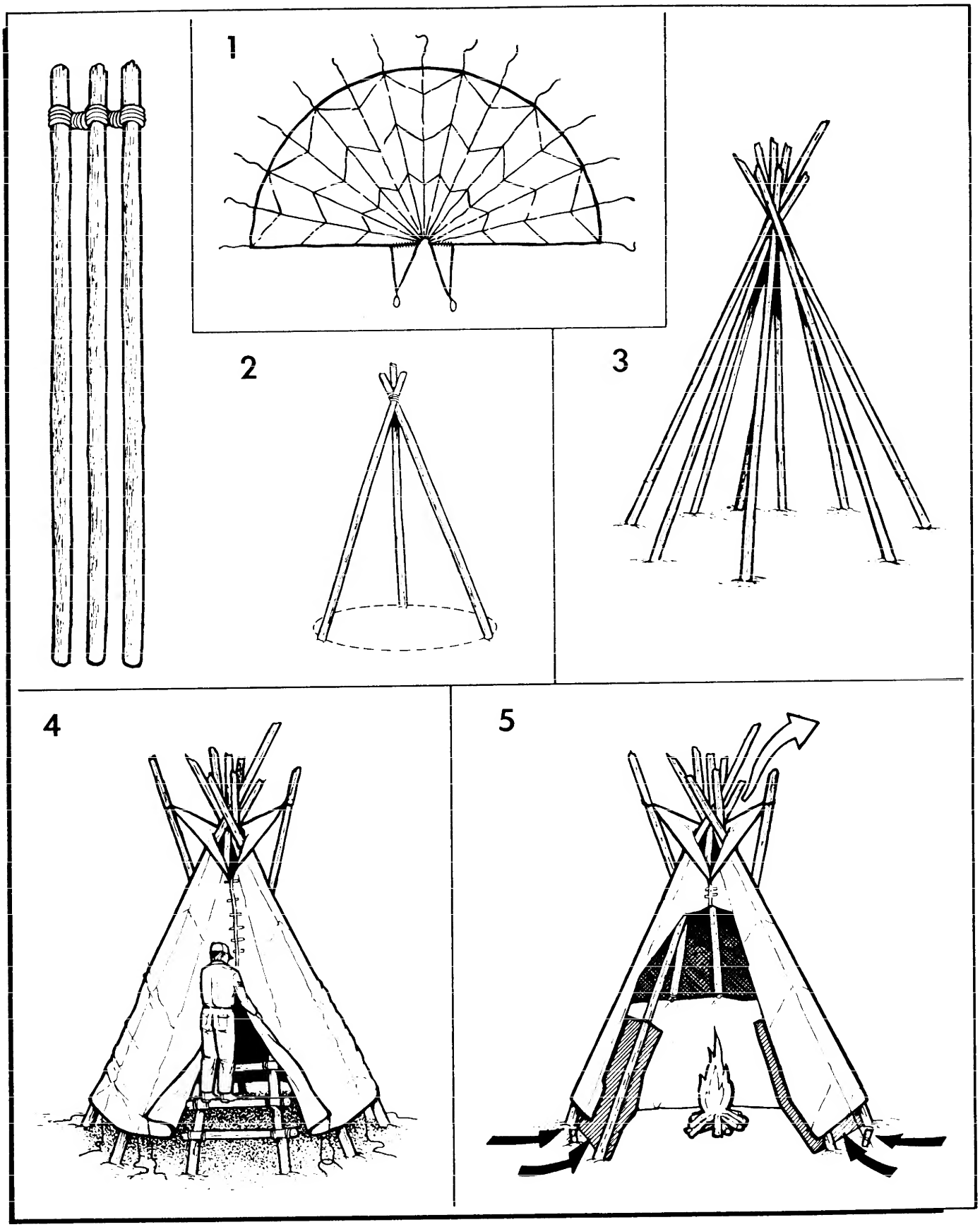


Figure 15-5. 9-Pole Tepee.

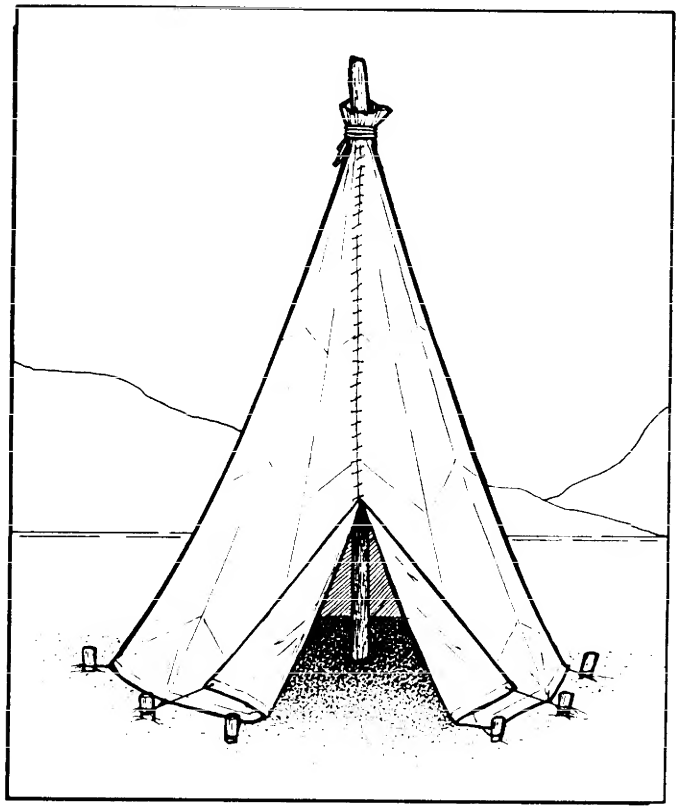


Figure 15-6. 1-Pole Tepee.

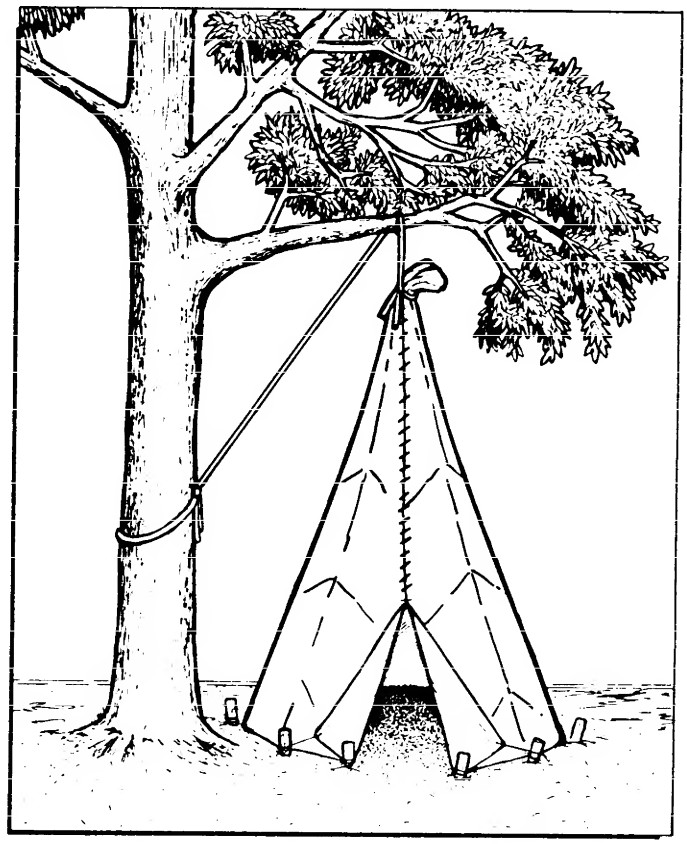


Figure 15-7. No-Pole Tepee.

b. Survivors should establish a campsite on a knoll or high spot in an open area well back from any swamps or marshy areas. The ground in these areas is drier, and there may be a breeze which will result in fewer insects.

c. Underbrush and dead vegetation should be cleared from the shelter site. Crawling insects will not be able to approach survivors as easily due to lack of cover.

d. A thick bamboo clump or matted canopy of vines for cover reflects the smoke from the campfire and discourages insects. This cover will also keep the extremely heavy early morning dew off the bedding.

e. The easiest improvised shelter is made by draping a parachute, tarpaulin, or poncho over a rope or vine stretched between two trees. One end of the canopy should be kept higher than the other; insects are discouraged by few openings in shelters and smudge fires. A hammock made from parachute material will keep the survivor off the ground and discourage ants, spiders, leeches, scorpions, and other pests.

f. In the wet jungle, survivors need shelter from dampness. If they stay with the aircraft, it should be used for shelter. They should try to make it mosquito-proof by covering openings with netting or parachute cloth.

g. A good rain shelter can be made by constructing an A-type framework and shingling it with a good thickness of palm or other broad leaf plants, pieces of bark, and mats of grass (figure 15-8).

h. Nights are cold in some mountainous tropical areas. Survivors should try to stay out of the wind and build a fire. Reflecting the heat off a rock pile or other barrier is a good idea. Some natural materials which can

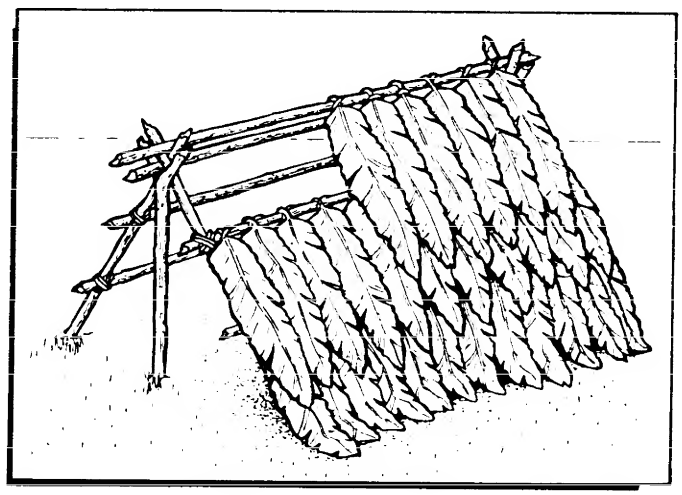


Figure 15-8. Banana Leaf A-Frame.

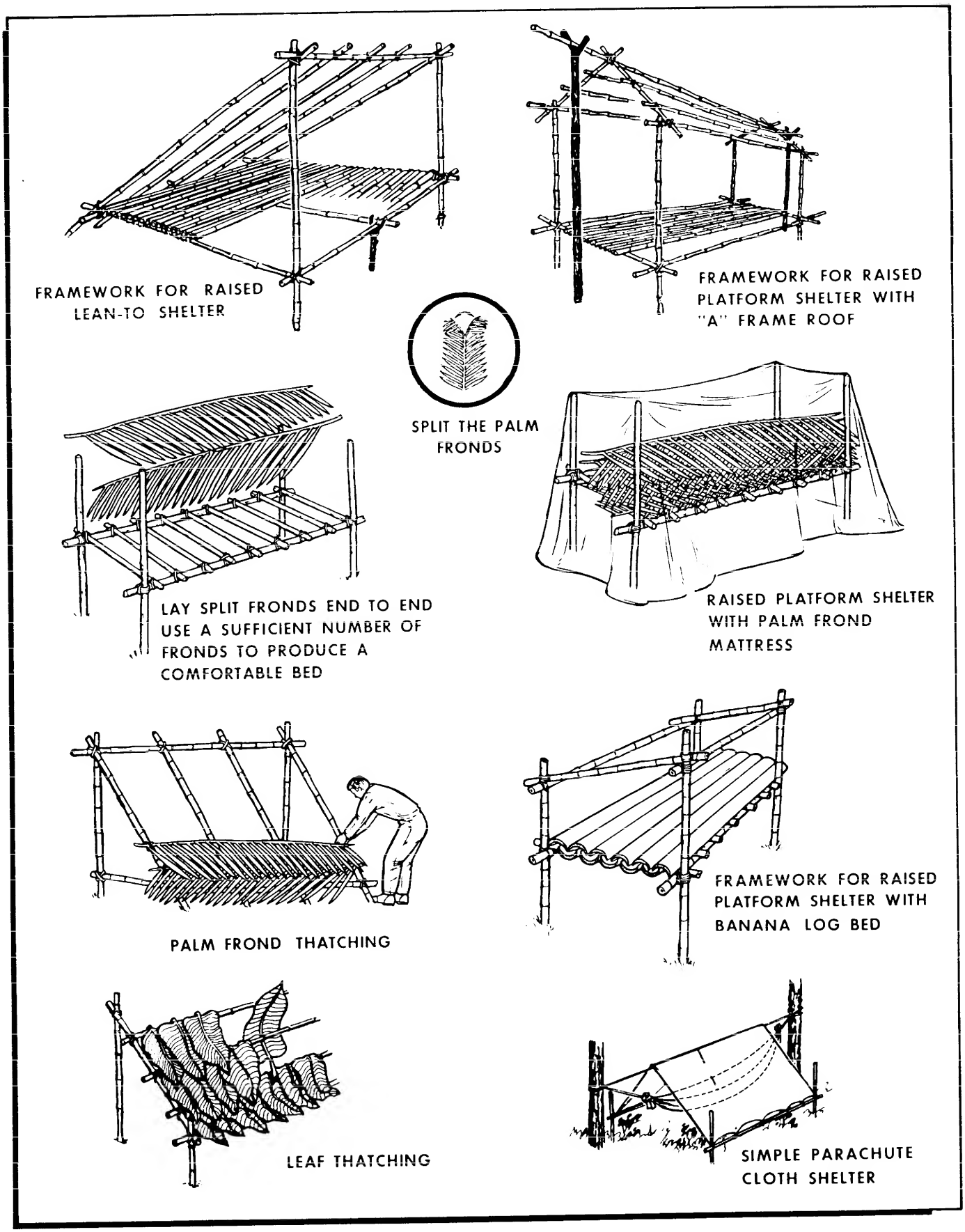


Figure 15-9. Raised Platform shelter.

be used in the shelters are green wood (dead wood may be too rotten), bamboo, and palm leaves. Vines can be used in place of suspension line for thatching roofs or floors, etc. Banana plant sections can be separated from the banana plant and fashioned to provide a mattress effect.

15-10. Specific Shelters for Tropical Environments:

a. Raised Platform Shelter (figure 15-9). This shelter has many variations. One example is four trees or vertical poles in a rectangular pattern which is a little longer and a little wider than the survivor, keeping in mind the survivor will also need protection for equipment. Two long, sturdy poles are then square lashed between the trees or vertical poles, one on each side of the intended shelter. Cross pieces can then be secured across the two horizontal poles at 6- to 12-inch intervals. This forms the platform on which a natural mattress may be constructed. Parachute material can be used as an insect net and a roof can be built over the structure using A-frame building techniques. The roof should be waterproofed with thatching laid bottom to top in a thick shingle fashion. See figure 15-9 for examples of this and other platform shelters. These shelters can also be built using three trees in a triangular pattern. At the foot of the shelter, two poles are joined to one tree.

b. Variation of Platform Shelter. A variation of the platform-type shelter is the paraplatform. A quick and comfortable bed is made by simply wrapping material around the two "frame" poles. Another method is to roll poles in the material in the same manner as for an improvised stretcher (figure 15-10).

c. Hammocks. Various parahammocks can also be made. They are more involved than a simple parachute wrapped framework and not quite as comfortable (figure 15-11).

d. Hobo Shelter. On tropical coasts and other coastal environments, if a more permanent shelter is desired as opposed to a simple shade shelter, survivors should build a "hobo" shelter. To build this shelter:

(1) Dig into the lee side of a sand dune to protect the shelter from the wind. Clear a level area large enough to lie down in and store equipment.

(2) After the area has been cleared, build a heavy driftwood framework which will support the sand.

(3) Wall sides and top with strong material (boards, driftwood, etc.) that will support the sand; leave a door opening.

(4) Slope the roof to equal the slope of the sand dune. Cover the entire shelter with parachute material to keep sand from sifting through small holes in the walls and roof.

(5) Cover with 6 to 12 inches of sand to provide protection from wind and moisture.

(6) Construct a door for the shelter (figure 15-12).

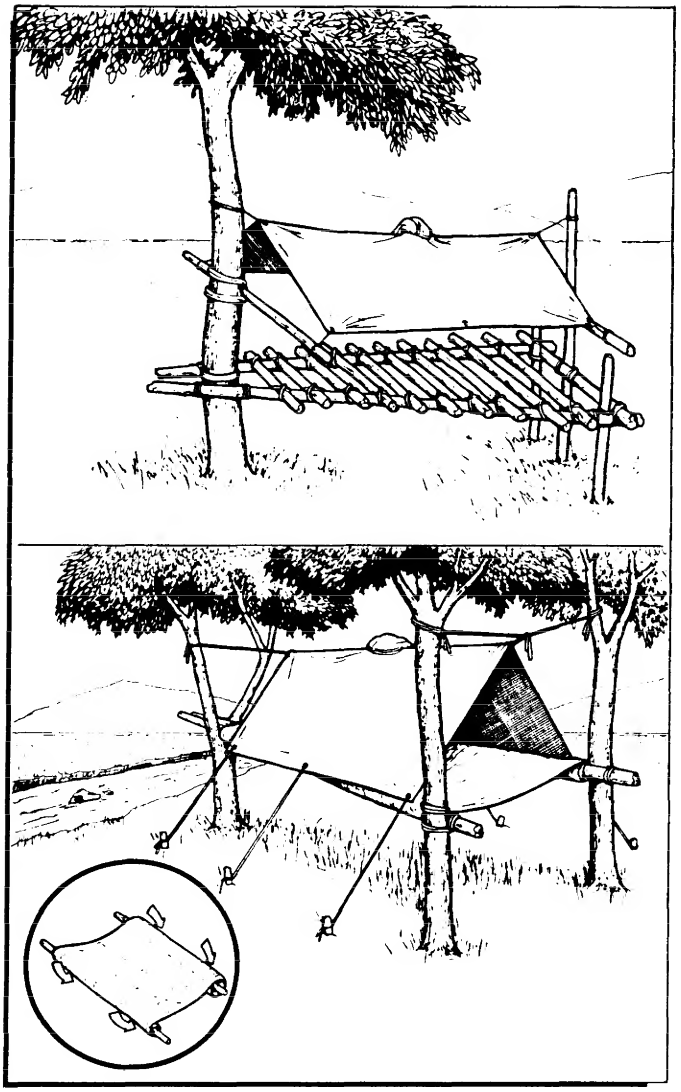


Figure 15-10. Raised Paraplatform Shelter.

15-11. Shelters for Dry Climates:

a. Natives of hot, dry areas make use of light-proof shelters with sides rolled up to take advantage of any breeze. Survivors should emulate these shade-type shelters if forced to survive in these areas. The extremes of heat *and* cold must be considered in hot areas, as most can become very cold during the night. The major problem for survivors will be escaping the heat and Sun rays.

b. Natural shelters in these areas are often limited to the shade of cliffs and the lee sides of hills, dunes, or rock formations. In some desert mountains, it is possible to find good rock shelters or cave-like protection under tumbled blocks of rocks which have fallen from cliffs. Use care to ensure that these blocks are in areas void of future rock falling activity and free from animal hazards.

c. Vegetation, if any exists, is usually stunted and armed with thorns. It may be possible to stay in the

shade by moving around the vegetation as the Sun moves. The hottest part of the day may offer few shadows because the Sun is directly overhead. Parachute material draped over bushes or rocks will provide some shade.

d. Materials which can be used in the construction of desert shelters include:

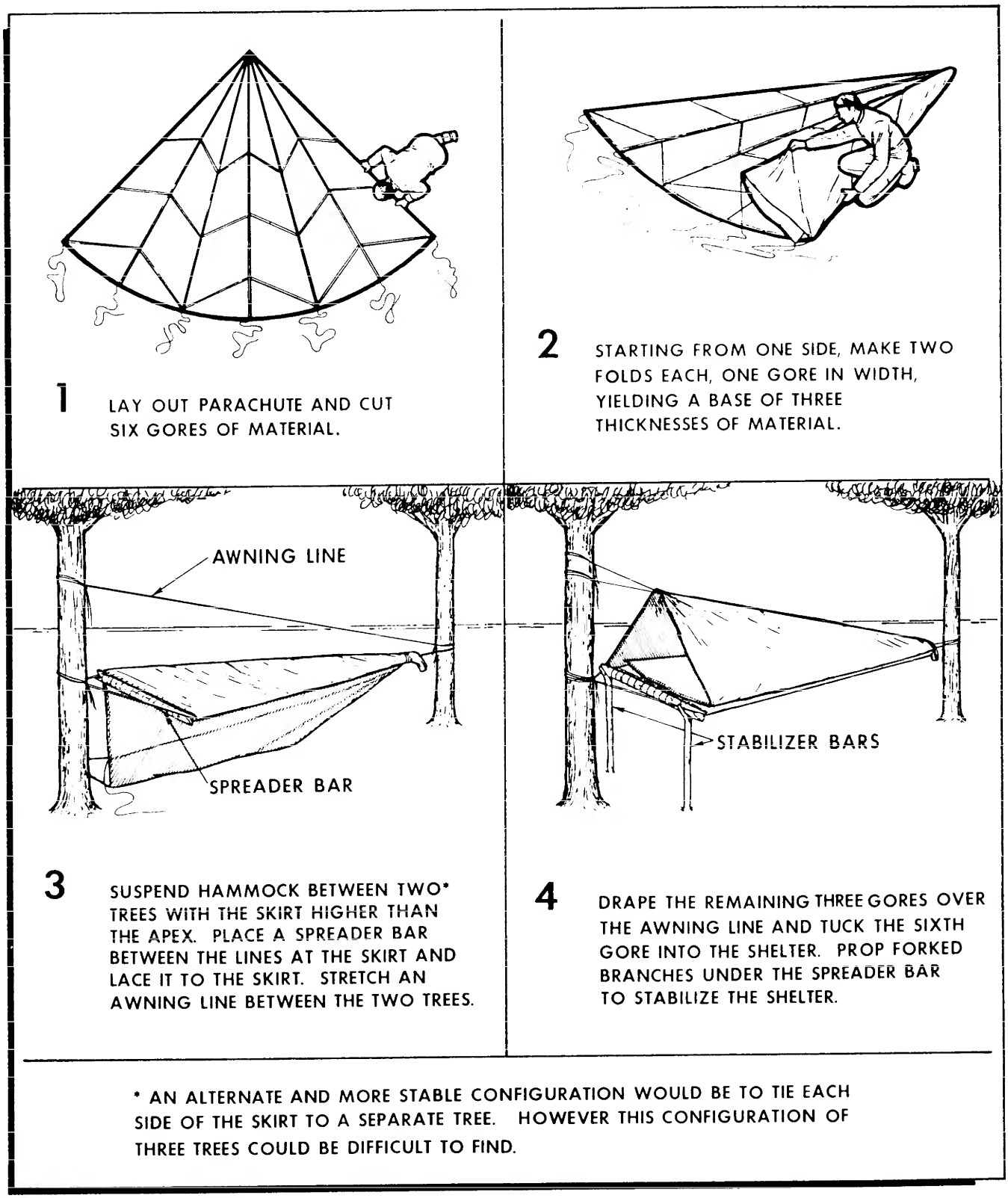


Figure 15-11. Parahammock.

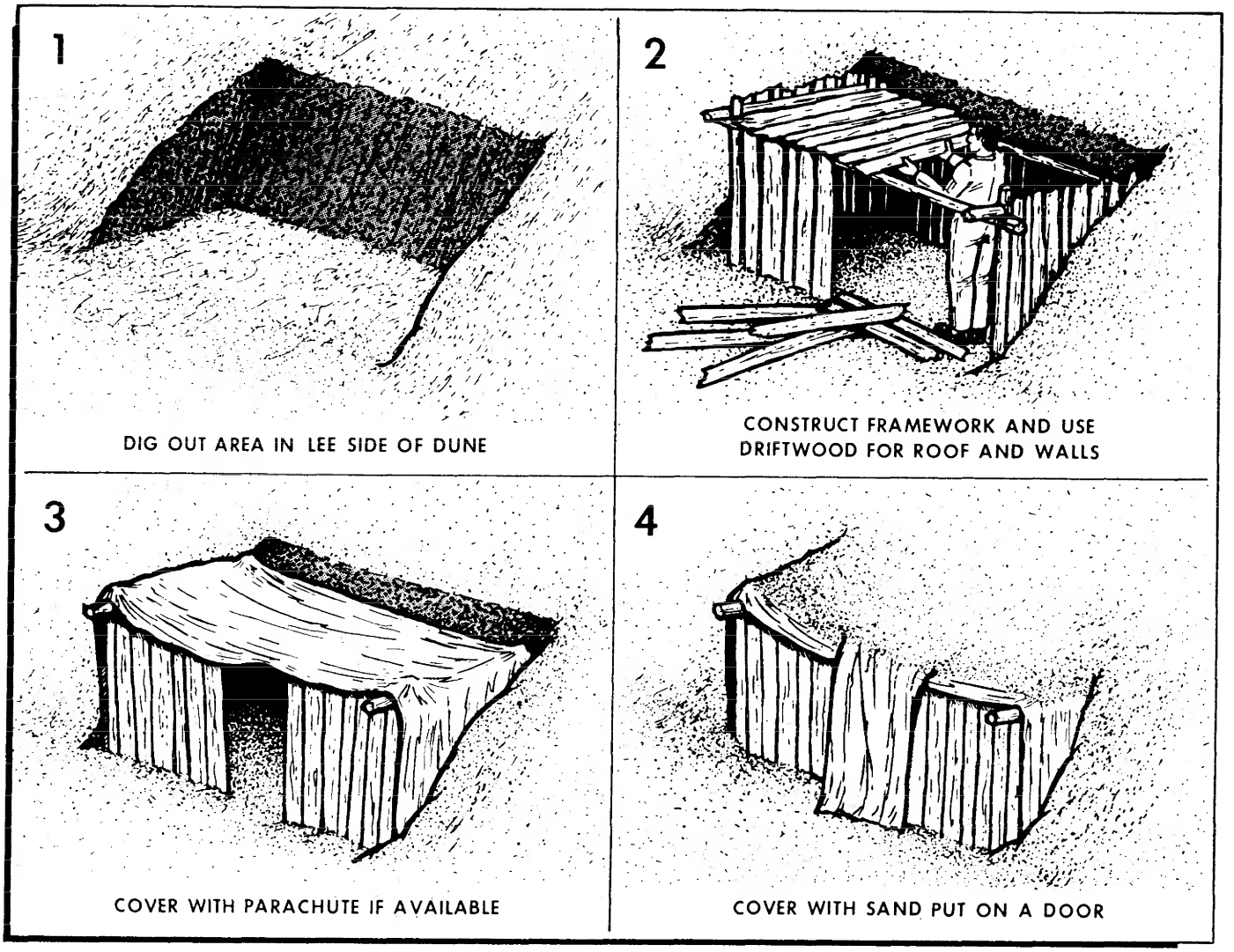


Figure 15-12. Hobo Shelter.

(1) Sand, though difficult to work with when loose, may be made into pillars by using sandbags made from parachute or any available cloth.

(2) Rock can be used in shelter construction.

(3) Vegetation such as sage brush, creosote bushes, juniper trees, and desert gourd vines are valuable building materials.

(4) Parachute canopy and suspension lines. These are perhaps the most versatile building materials available for use by survivors. When used in layers, parachute material protects survivors from the Sun's rays.

(a) The shelter should be made of dense material or have numerous layers to reduce or stop dangerous ultraviolet rays. The colors of the parachute materials used make a difference as to how much protection is provided from ultraviolet radiation. As a general rule, the order of preference should be to use as many layers as practical in the order of orange, green, tan, and white.

ULTRAVIOLET TESTS ON PARACHUTE CANOPY MATERIAL

% Ultraviolet (Short Wave 2537 A° Sunburn Rays) Blocked as compared to Direct Exposure

	1 Layer	2 Layers	3 Layers
Orange	78.2%	96.2%	99.36%
Sage Green	79.5%	96.2%	98.7%
Tan	64.1%	84.6%	93.6%
White	47.5%	61.6%	70.5%

% Ultraviolet (Long Wave 3660 A°) Blocked as Compared to Direct Exposure

	1 Layer	2 Layers	3 Layers
Orange	63.4%	92.3%	97.8%
Sage Green	60.0%	88.9%	97.8%
Tan	38.9%	66.7%	82.3%
White	28.9%	47.8%	58.9%

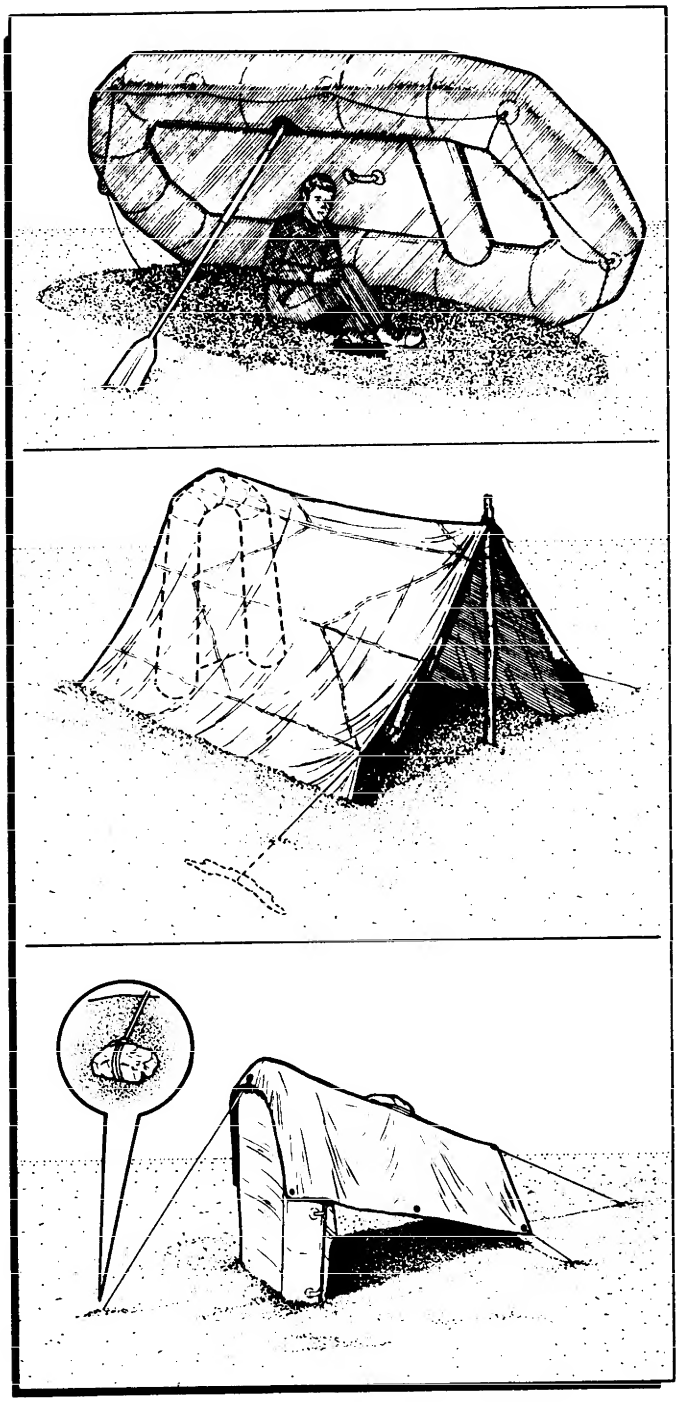


Figure 15-13. Improvised Natural Shade Shelters.

(b) The material should be kept approximately 12 to 18 inches above the individual. This allows the air to cool the underside of the material.

(c) Aircraft parts and liferafts can also be used for shade shelters. Survivors may use sections of the wing, tail, or fuselage to provide shade. However, the interior of the aircraft will quickly become superheated and should be avoided as a shelter. An inflatable raft can be tilted against a raft paddle or natural object such as a bush or rock to provide relief from the Sun (figure 15-13).

15-12. Principles of Desert Shelters:

a. The roof of a desert shelter should be multilayered so the resulting airspace reduces the inside temperature of the shelter. The layers should be separated 12 to 18 inches apart (figure 15-14).

b. Survivors should place the floor of the shelter about 18 inches above or below the desert surface to increase the cooling effect.

c. In warmer deserts, white parachute material should be used as an outer layer. Orange or sage green material should be used as an inner layer for protection from ultraviolet rays.

d. In cooler areas, multiple layers of parachute material should be used with sage green or orange material as the outer layer to absorb heat.

e. The sides of shelters should be movable in order to protect survivors during cold and (or) windy periods and to allow for ventilation during hot periods.

f. In a hot desert, shelters should be built away from large rocks which store heat during the day. Survivors may need to move to the rocky areas during the evening to take advantage of the warmth heated rocks radiate.

g. Survivors should:

(1) Build shelters on the windward sides of dunes for cooling breezes.

(2) Build shelters during early morning, late evening, or at night. However, potential survivors should recall that survivors who come down in a desert area during daylight hours must be immediately concerned with protection from the Sun and loss of water. In this case, parachute canopy material can be draped over liferaft, vegetation, or a natural terrain feature for quick shelter.

15-13. Shelters for Snow and Ice Areas:

a. The differences in arctic and arctic-like environments create the need for different shelters. Basically, there are two types of environments which may require special shelter characteristics or building principles before survivors will have adequate shelter. They are:

(1) Barren lands which include some seacoasts, icecaps, sea ice areas, and areas above the tree line.

(2) Tree-line areas.

b. Barren lands offer a limited variety of materials for shelter construction. These are snow, small shrubs, and grasses. Ridges formed by drifting or wind-packed snow may be used for wind protection (survivors should build on the lee side). In some areas, such as sea ice, windy conditions usually exist and cause the ice to shift forming pressure ridges. These areas of unstable ice and snow should be avoided at all times. Shelters which are suitable for barren-type areas include:

(1) Molded dome (figure 15-15).

(2) Snow cave (figure 15-16).

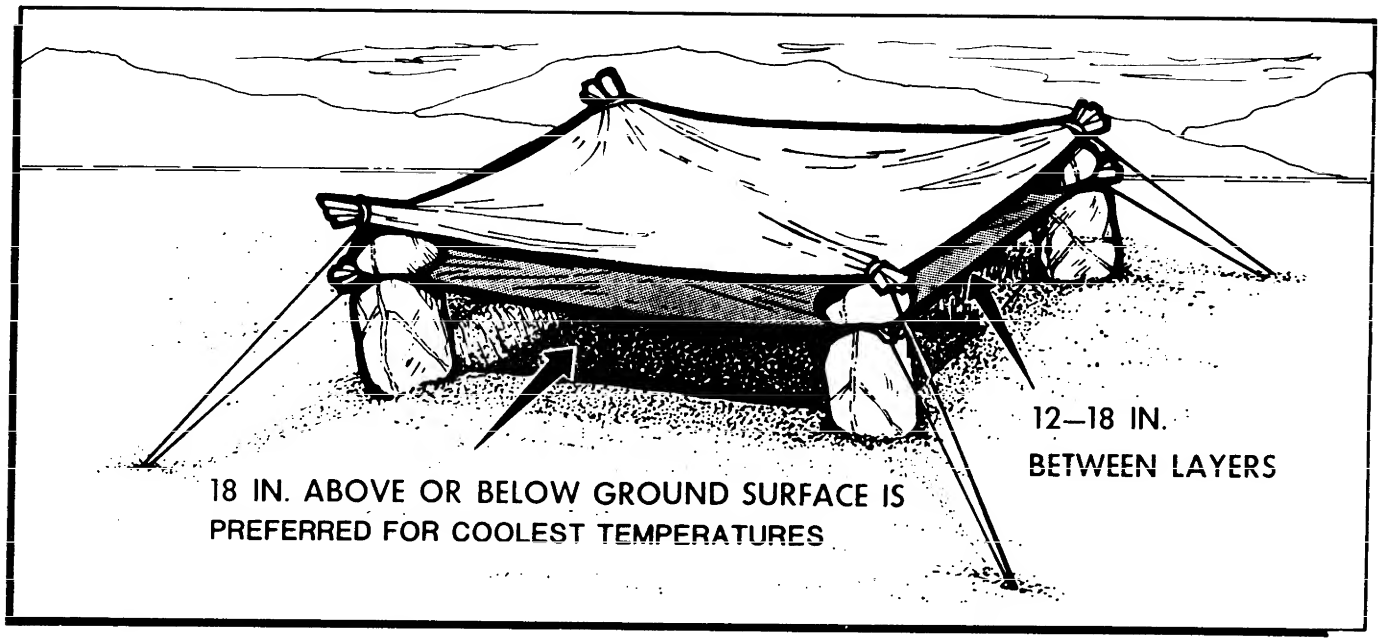


Figure 15-14. Parachute Shade Shelter.

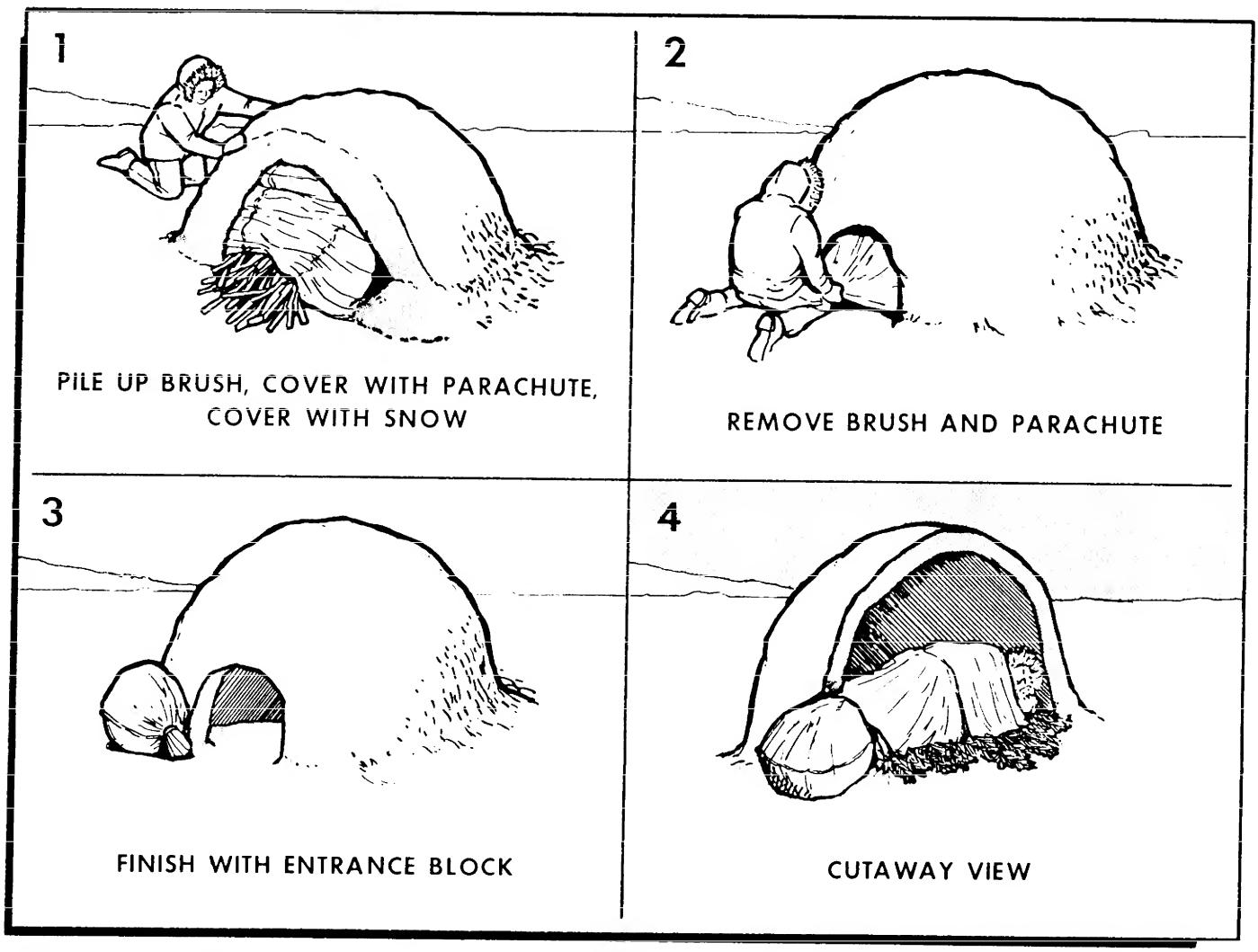


Figure 15-15. Molded Dome Shelter.

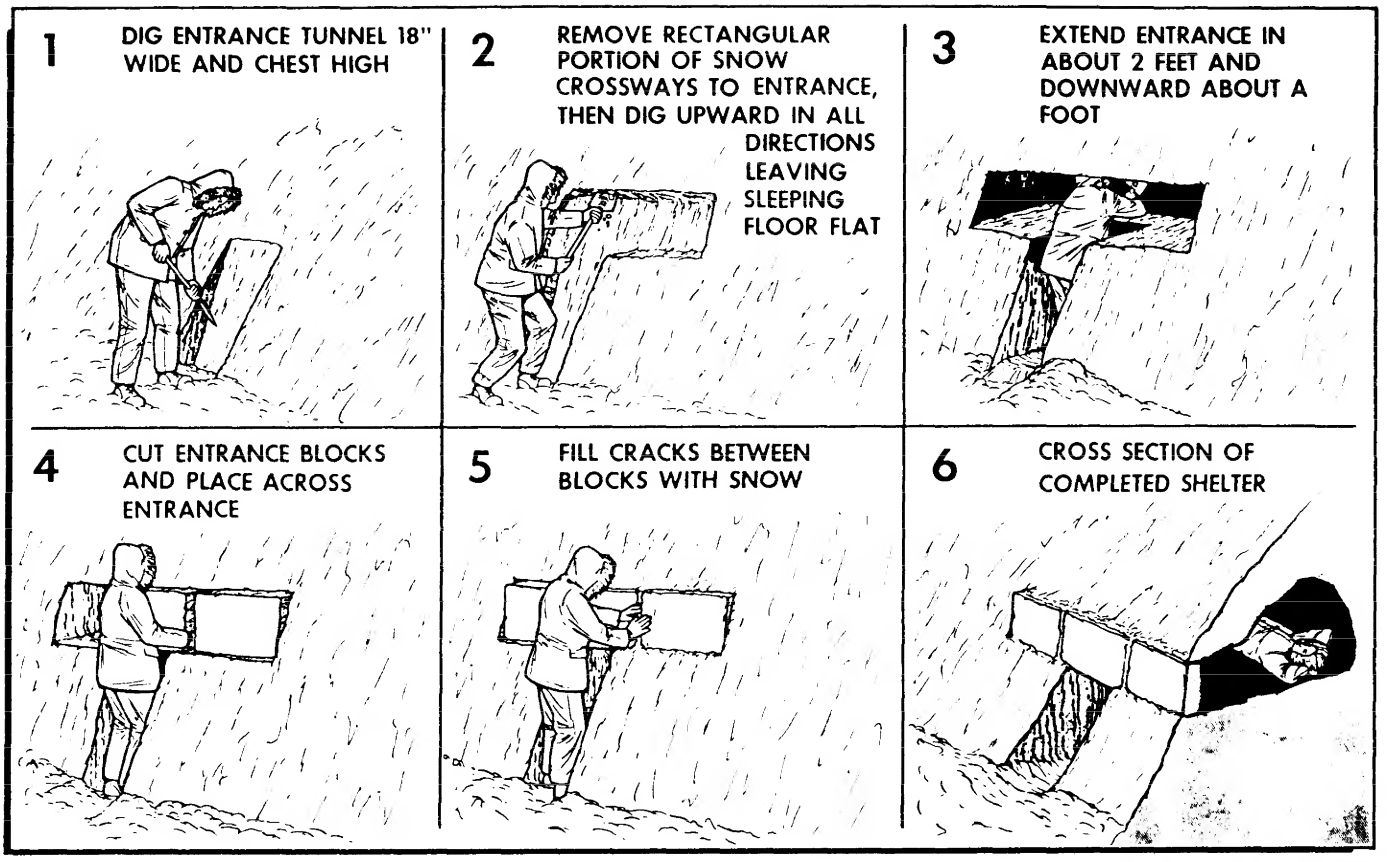


Figure 15-16. Snow Cave.

(3) Fighter trench (figure 15-17).
(4) Igloo (figure 15-18).
(5) Para-snow house (Figure 15-19).

NOTE: Of these, the ones that are quick to construct and require minimum effort and energy are the molded dome, snow cave, and fighter trench. It is important to know which of these shelters is the easiest to build since reducing or eliminating the effect of the windchill factor is essential to remaining alive.

c. In tree-covered areas, sufficient natural shelter building materials are normally available. Caution is required. Shelters built near rivers and streams may get caught in the overflow.

d. Tree-line area shelter types include:
(1) Thermal A-Frame construction (figure 15-20).
(2) Lean-to or wedge (figure 15-21).
(3) Double lean-to (figure 15-22).
(4) Fan (figure 15-23).
(5) Willow frame (figure 15-24).
(6) Tree well (figure 15-25).

e. Regardless of the type of shelter used, the use of thermal principles and insulation in arctic shelters is required. Heat radiates from bare ground and from ice masses over water. This means that shelter areas on land should be dug down to bare earth if possible (figure 15-26). A minimum of 8 inches of insulation above survivors is needed to retain heat. All openings except ventilation holes should be sealed to avoid heat loss. Leaving vent holes open is especially important if heat producing devices are used. Candles, sterno, or small oil lamps produce carbon monoxide. In addition to the ventilation hole through the roof, another may be required at the door to ensure adequate circulation of the air. (As a general rule, unless persons can see their breath, the snow shelter is too warm and should be cooled down to proclude melting and dripping.)

f. Regardless of how cold it may get outside, the temperature inside a small well-constructed snow cave will probably not be lower than -10°F. Body heat alone can raise the temperature of a snow cave 45 degrees above the outside air. A burning candle will raise the temperature 4 degrees. Burning Sterno (small size, 2⅝ oz) will raise the cave temperature about 28 degrees. However, since they cannot be heated many degrees above freezing, snow shelters provide a rather rugged life. Once the inside of the shelter "glazes" over with ice, this layer of ice should be removed by chipping it off or a new shelter built since ice reduces the insulating quality of a shelter. Maintain the old shelter until the new one is constructed. It will provide protection from the wind.

g. The aircraft should not be used as a shelter when temperatures are below freezing except in high wind conditions. Even then a thermal shelter should be constructed as soon as the conditions improve. The aircraft

will not provide adequate insulation, and the floor will usually become icy and hazardous.

15-14. General Construction Techniques:

a. All thermal shelters use a layering system consisting of the frame, parachute (if available), boughs or shrubs, and snow. The framework must be sturdy enough to support the cover and insulation. A door block should be used to minimize heat loss. Insulation should be added on sleeping areas.

b. If a barren land-type shelter is being built with snow as the only material, a long knife or digging tool is a necessity. It normally takes 2 to 3 hours of hard work to dig a snow cave, and much longer for the novice to build an igloo.

c. Survivors should dress lightly while digging and working; they can easily become overheated and dampen their clothing with perspiration which will rapidly turn to ice.

d. If possible, all shelter types should have their openings 90 degrees to the prevailing wind. The entrance to the shelter should also be screened with snowblocks stacked in a L-shape.

e. Snow on the sea ice, suitable for cutting into blocks, will usually be found in the lee of pressure ridges or ice hummocks. The packed snow is often so shallow that the snowblocks have to be cut out horizontally.

f. No matter which shelter is used, survivors should take a digging tool into the shelter at night to cope with the great amount of snow which may block the door during the night.

15-15. Shelter Living:

a. Survivors should limit the number of shelter entrances to conserve heat. Fuel is generally scarce in the

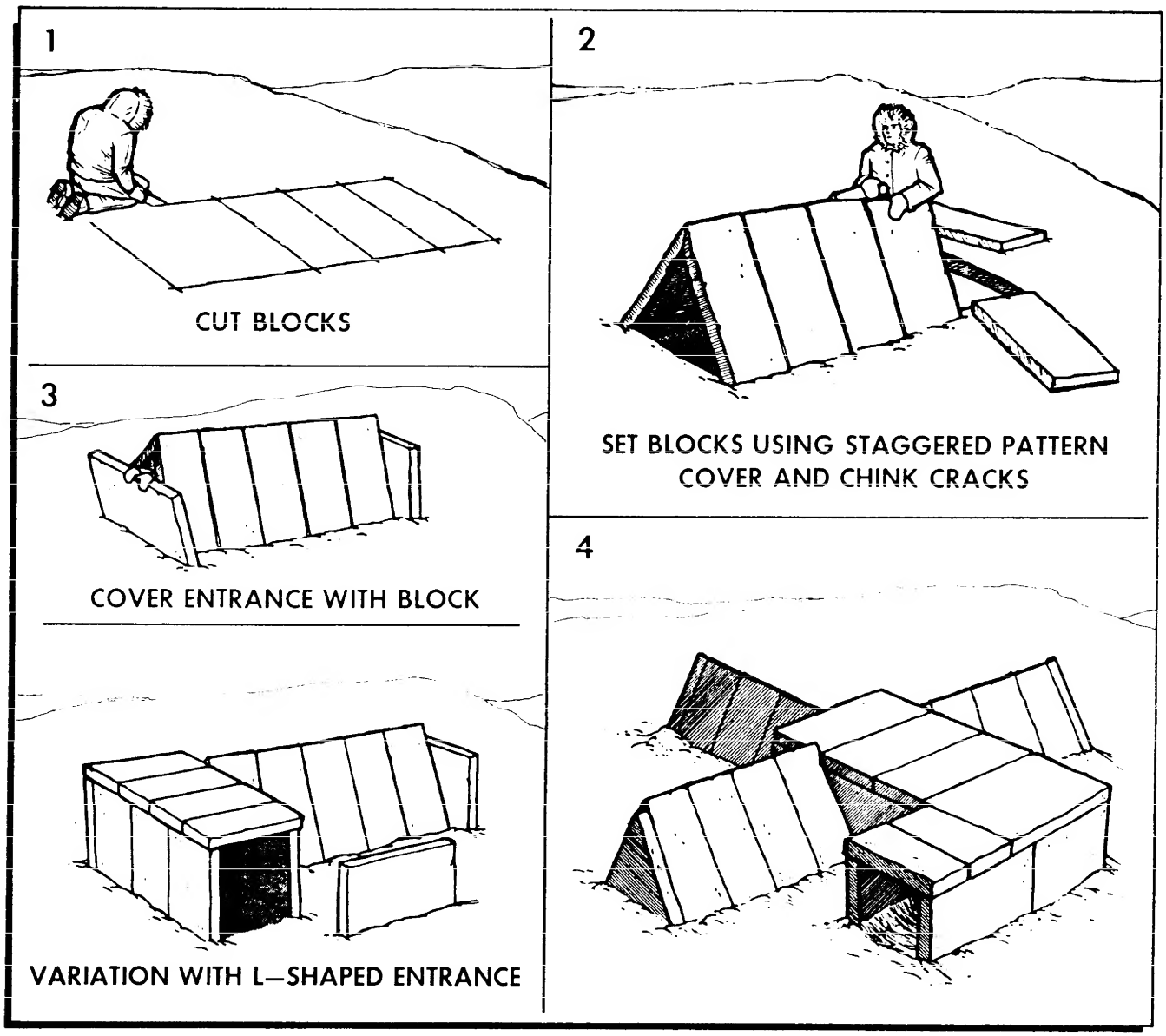


Figure 15-17. Fighter Trench.

arctic. To conserve fuel, it is important to keep the shelter entrance sealed as much as possible (figure 15-27). When it is necessary to go outside the shelter, activities such as gathering fuel, snow or ice for melting, etc., should be done. To expedite matters, a trash receptacle may be kept inside the door, and equipment may be stored in the entry way. Necessities which cannot be stored inside may be kept just outside the door. Any firearms (guns) the survivor may have must be stored outside the shelter to prevent condensation building which could cause them to malfunction.

b. A standard practice in snow shelter living is for people to relieve themselves indoors when possible. This practice conserves body heat. If the snowdrift is large enough to dig connecting snow caves, one may be used as a toilet room. If not, tin cans may be used for urinals, and snowblocks for solid waste (fecal) matter.

c. Survivors should use thick insulation under themselves when sleeping or resting even if they have a sleeping bag. They can use a thick bough bed in shingle-fashion, seat cushions, parachute, or an inverted and inflated rubber raft.

d. Outer clothing makes good mattress material. A parka makes a good footbag. The shirt and inner trousers may be rolled up for a pillow. Socks and insoles can be separated and aired in the shelter. Drying may be completed in the sleeping bag by stowing around the hips. This drying method should only be used as a last resort.

e. Keeping the sleeping bag clean, *dry*, and fluffed will give maximum warmth. To dry the bag, it should be turned inside out, frost beaten out, and warmed before the fire—taking care that it doesn't burn.

f. To keep moisture (from breath) from wetting the sleeping bag, a moisture cloth should be improvised from a piece of clothing, a towel, or parachute fabric. It can then be lightly wrapped around the head in such a way that the breath is trapped inside the cloth. A piece of fabric dries easier than a sleeping bag. If cold is experienced during the night, survivors should exercise by fluttering their feet up and down or by beating the inside of the bag with their hands. Food or hot liquids can be helpful.

g. Snow remaining in clothing will melt in a warm shelter. When the clothing is again taken outside, the water formed will turn to ice and reduce the CLo value. Brush clothes before entering the shelter. Under living conditions where drying clothing is difficult, it is easier to keep clothing from getting wet than having to dry it out later.

h. If all the snow cannot be eliminated from outer clothing, survivors should remove the clothing and store it in the entry way or on the floor away from the source of heat so it remains cold. If ice should form in clothing, it may be beaten out with a stick.

i. In the cramped quarters of any small emergency shelter, pots of food or drink can be accidentally kicked over. The cooking area, even if it is only a Sterno stove, should be located out of the way, possibly in a snow alcove.

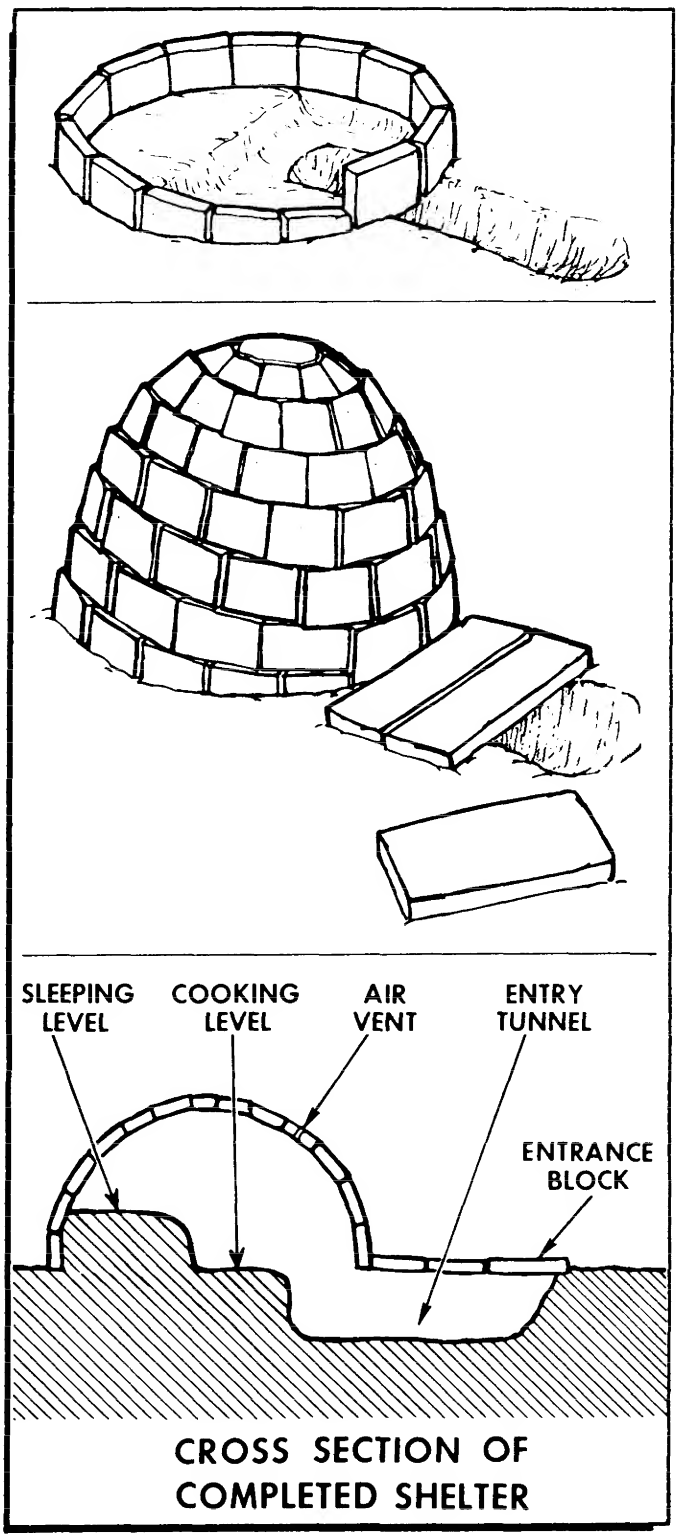


Figure 15-18. Igloo.

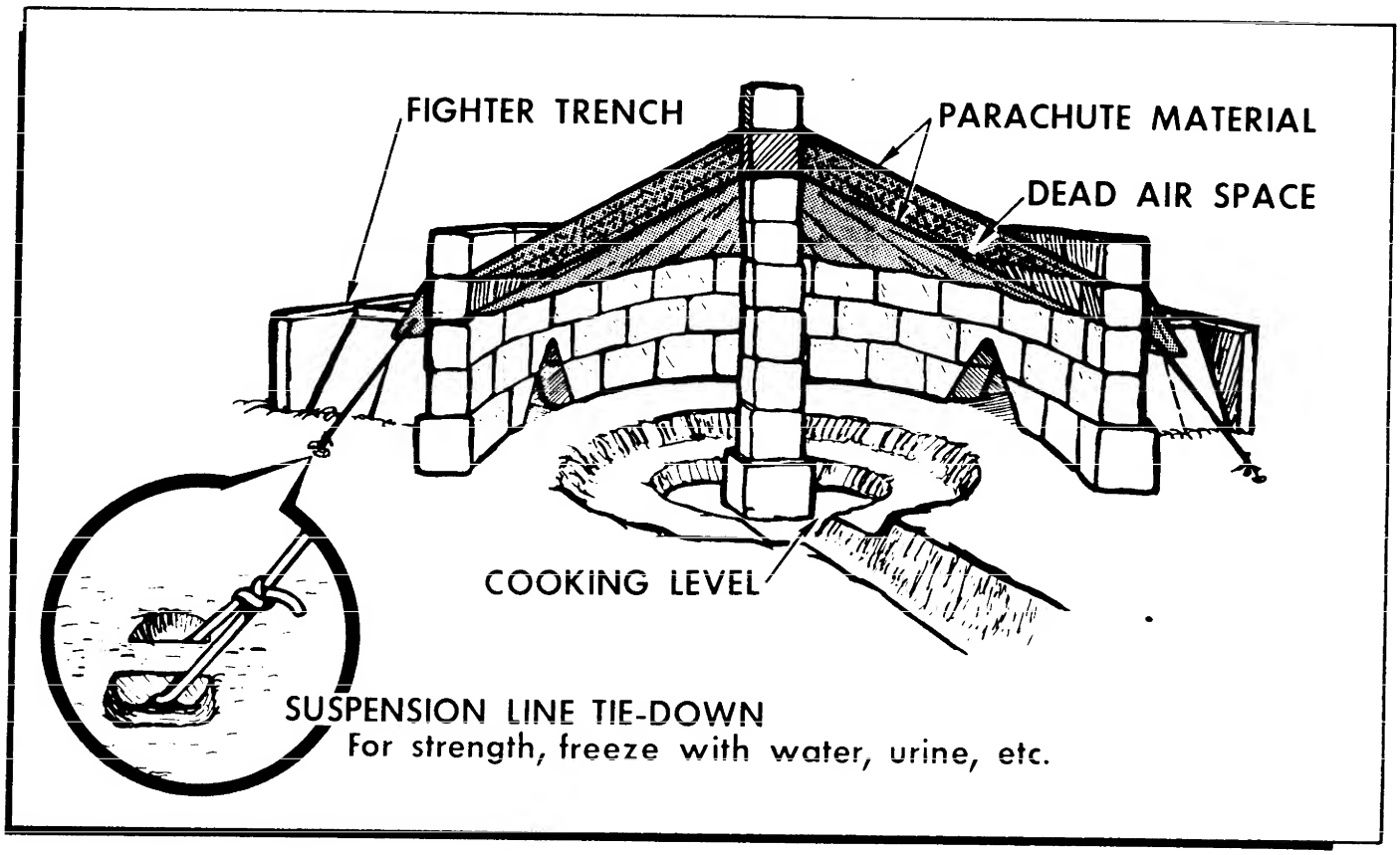


Figure 15-19. Para-Snow House.

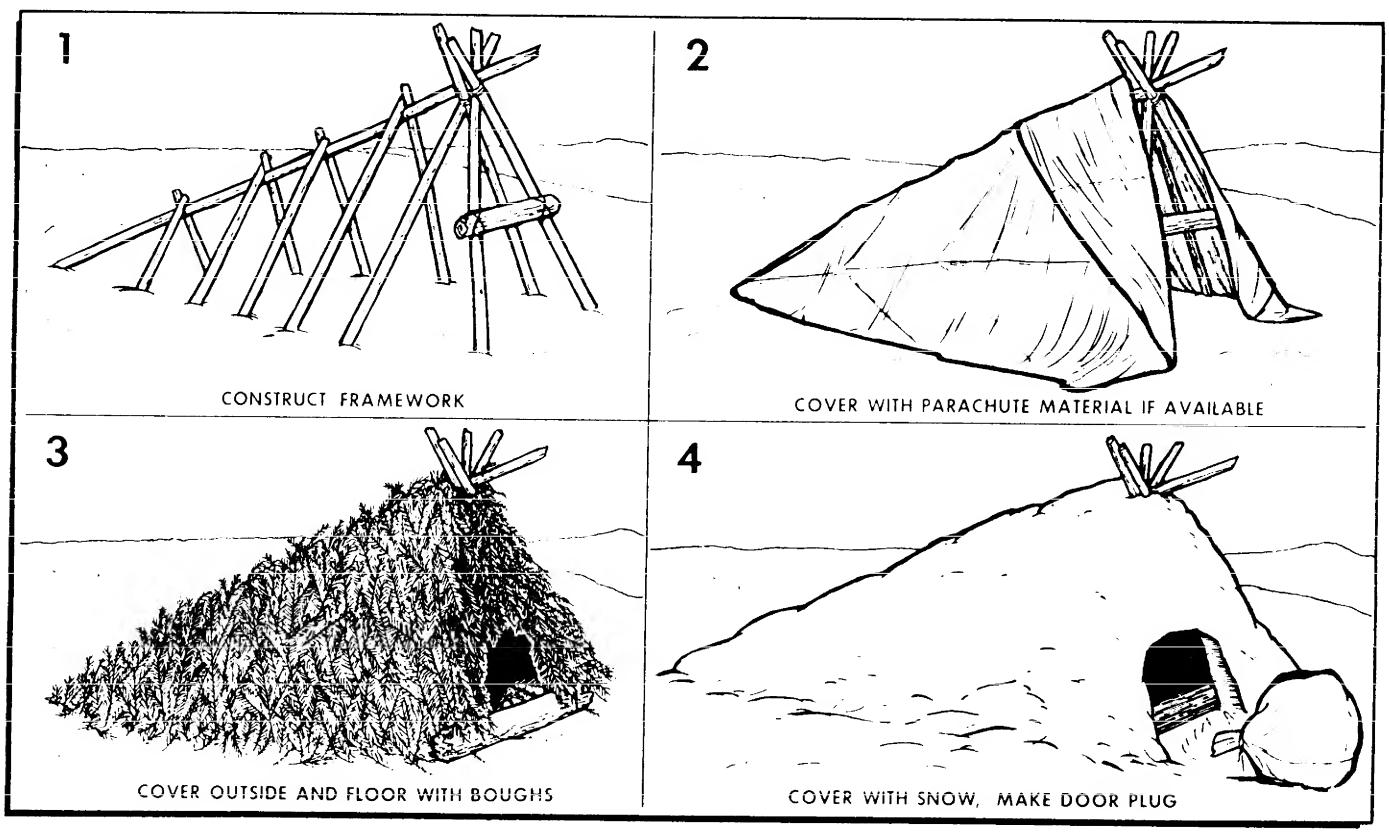


Figure 15-20. Thermal A-Frame.

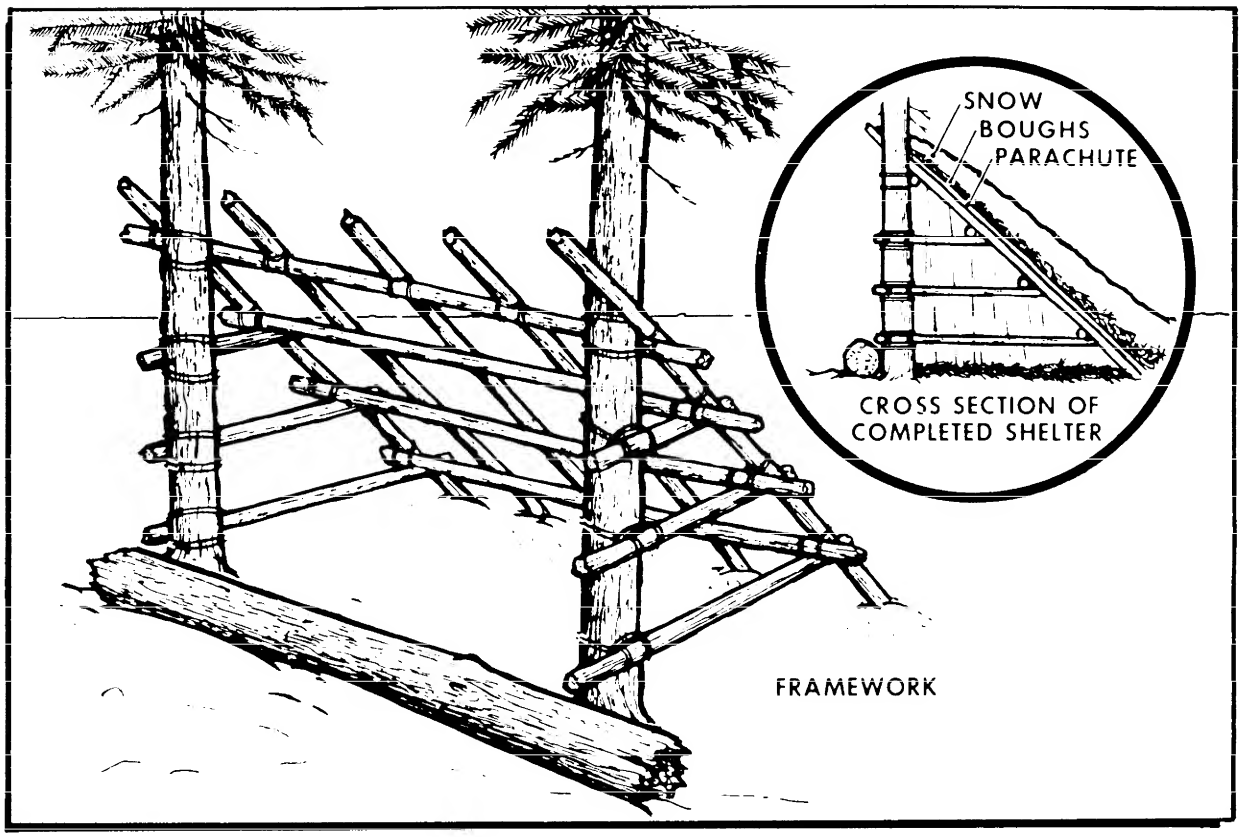


Figure 15-21. Lean-To or Wedge.

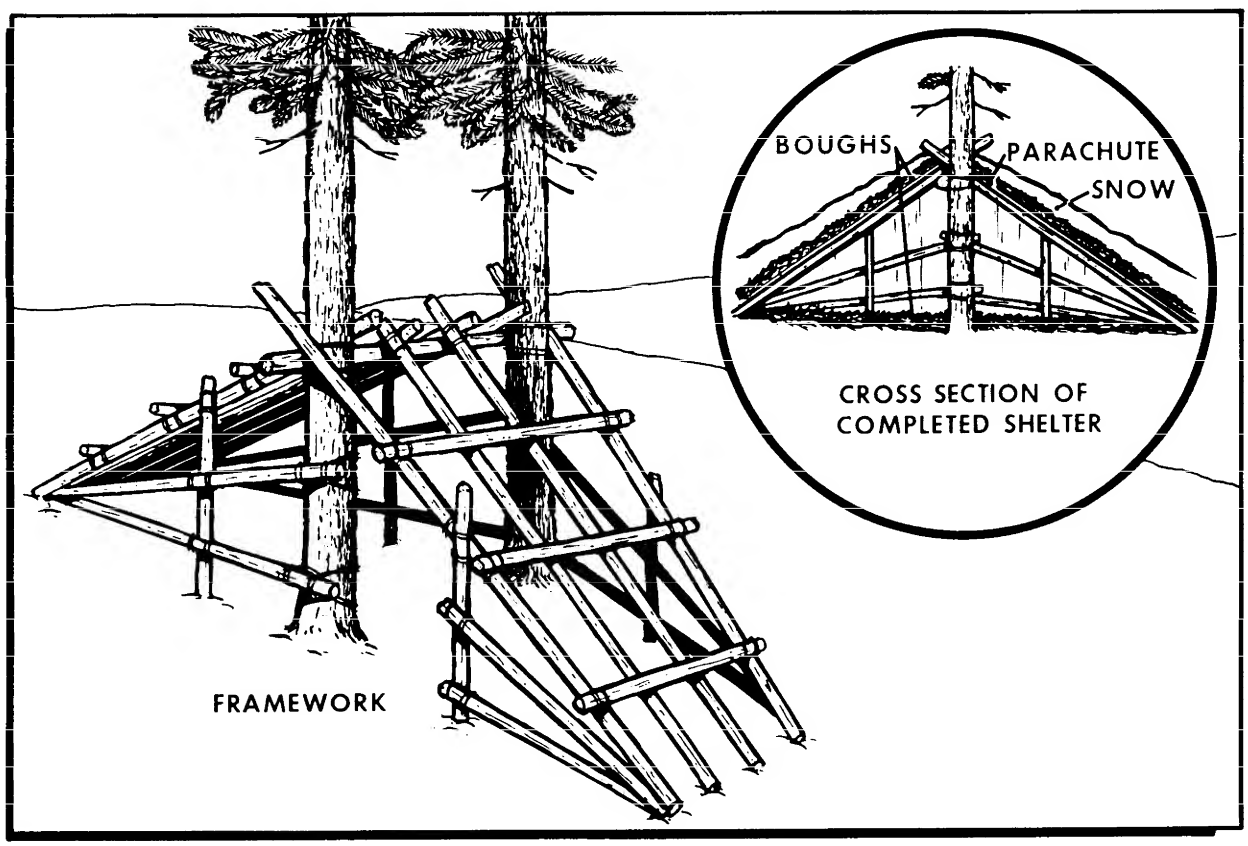


Figure 15-22. Double Lean-To.

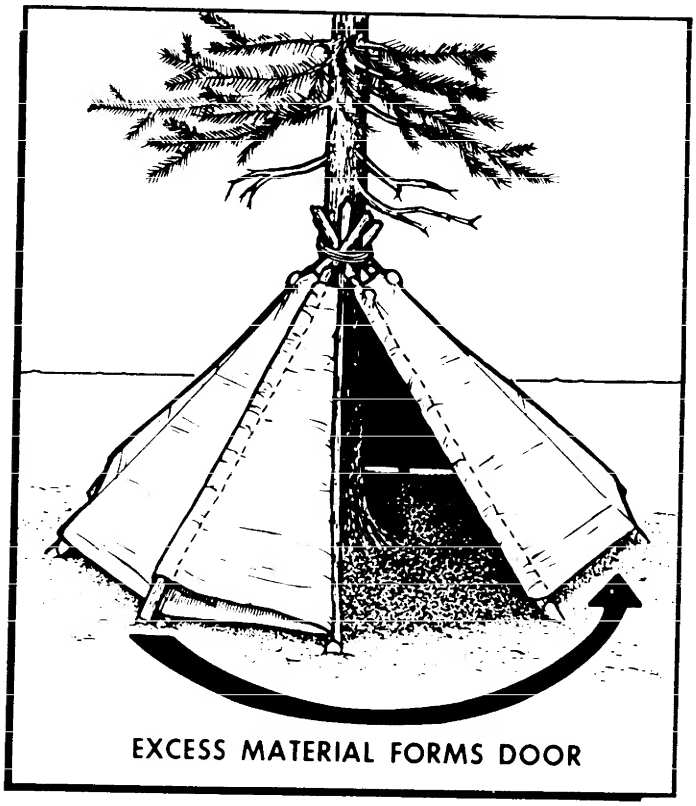


Figure 15-23. Fan Shelter.

15-16. Summer Considerations for Arctic and Arctic-Like Areas:

a. Survivors need shelter against rain and insects. They should choose a campsite near water but on high, dry ground if possible. Survivors should also stay away from thick vegetation, as mosquitoes and flies will make life miserable. A good campsite is a ridge top, cold lake shore, or a spot which gets a breeze.

b. If survivors stay with the aircraft, it can be used for shelter during the summer. They should cover openings with netting or parachute cloth to keep insects out and cook outside to avoid carbon monoxide poisoning. Fires must be built a safe distance from the aircraft.

c. Many temperate area shelters are suitable for summer arctic conditions. The paratepee (of the 1- or no-pole variety) is especially good. It will protect from precipitation and keep insects out.

15-17. Shelter for Open Seas. Personal protection from the elements is just as important on the seas as it is anywhere else. Some rafts come equipped with insulated floors, spray shields, and canopies to protect survivors from heat, cold, and water. If rafts are not so equipped or the equipment has been lost, survivors should try to improvise these items using parachute material, clothing, or other equipment.

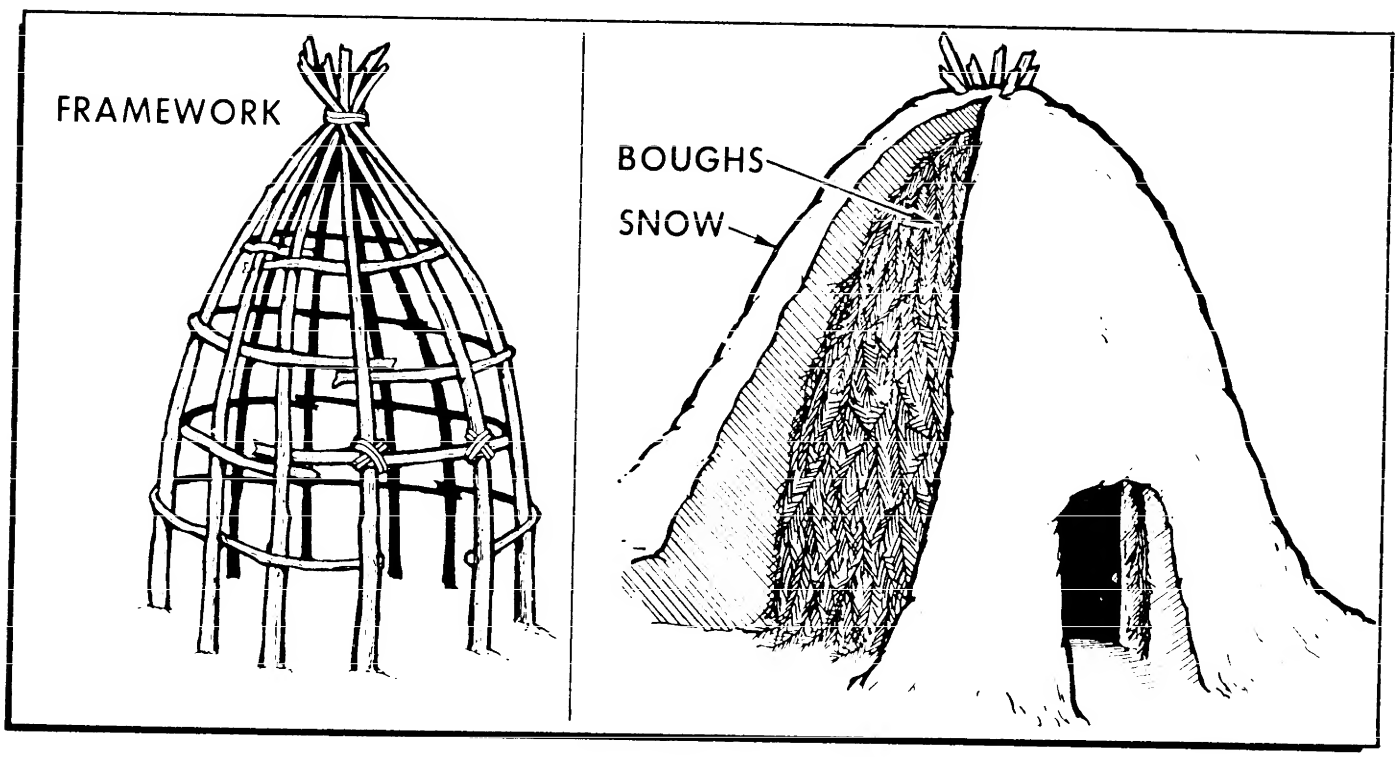


Figure 15-24. Willow Frame Shelter.

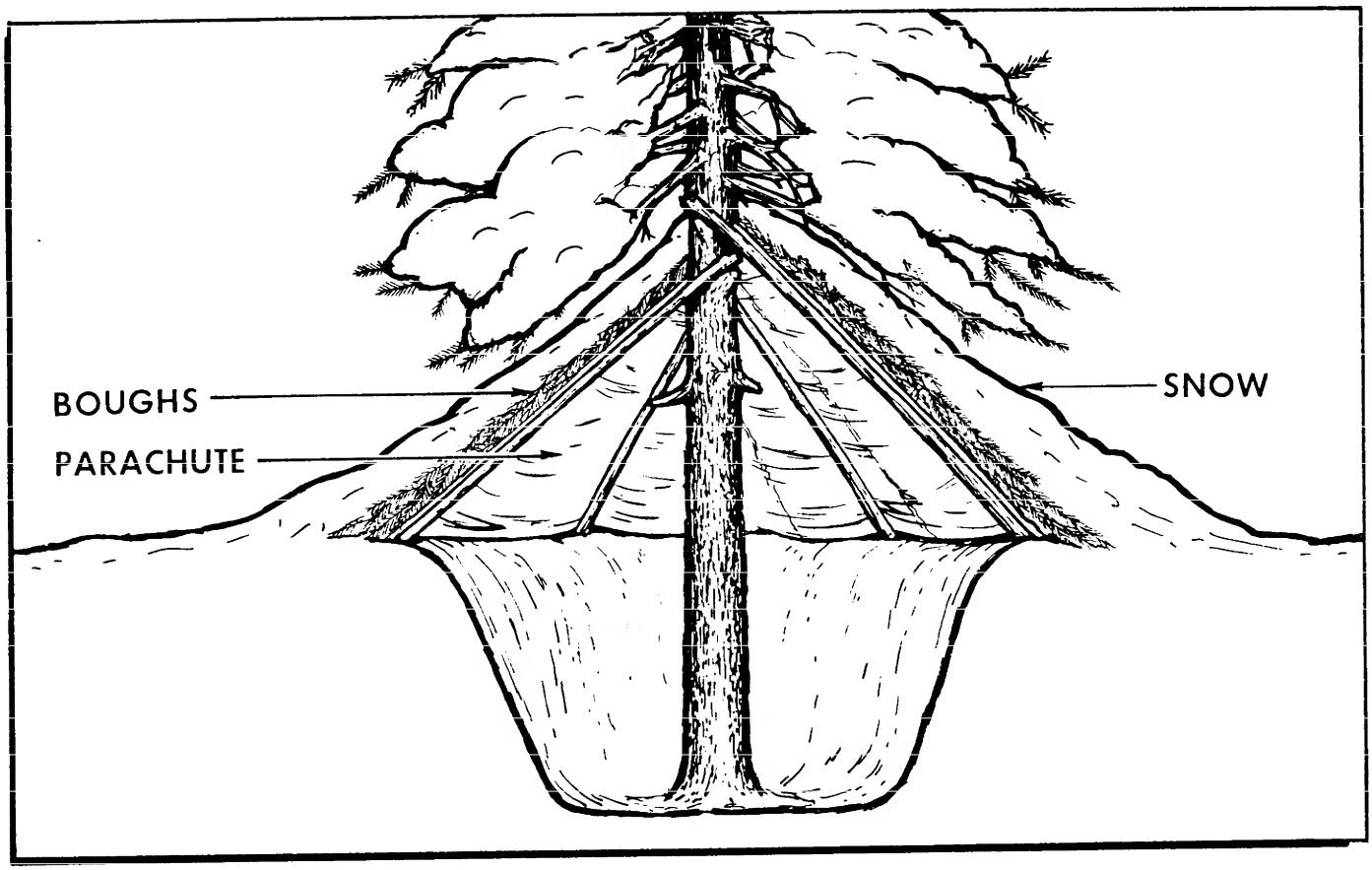


Figure 15-25. Tree Well Shelter.

Figure 15-26. Scraping Snow to Bare Earth.

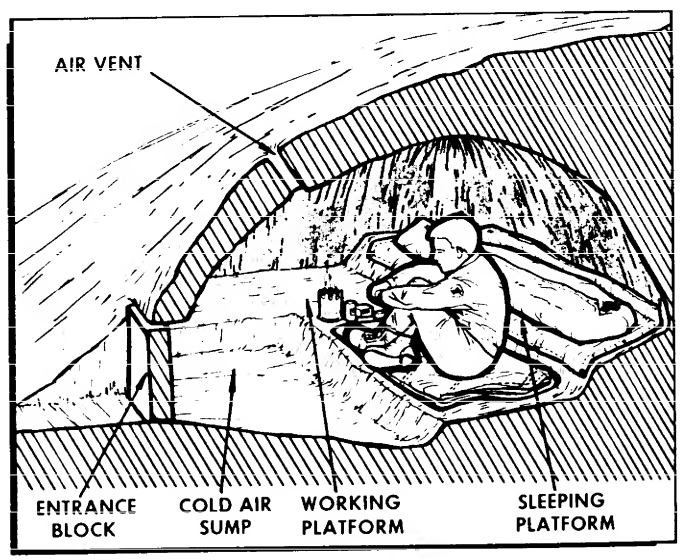


Figure 15-27. Snow Cave Shelter Living.